THE

# ELECTRICAL REVIEW.

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## ELECTRICAL REVIEW.

Vol. LXXIII.] CONTENTS: August 15, 1913. [No. 1,864.

| | Page |
|---|---|
| Labour Agreements | 241 |
| Gas-Electrical Plant at Accrington | 242 |
| Hydro-Electric Works in Norway | 242 |
| Central Station Advertising | 242 |
| The Wireless Contract | 243 |
| The Vehicle Charging Load: A Canadian Outlook | 244 |
| Correspondence— | |
| Dry and Wet Air Filters | 245 |
| Systems of Wages Payment and "Scientific Management" | 245 |
| Shift Engineers: A Proposal | 245 |
| Some New Forms of Recording Instruments (*illus.*) | 245 |
| Trade Names and Trade Descriptions | 247 |
| Petrol-Electric 'Buses: Transmission Trains and Operating Costs (*illus.*) | 249 |
| Imperial Wireless System | 250 |
| The Electrical Heat Treatment of Tool Steels (*illus.*) | 251 |
| Legal | 252 |
| Business Notes | 253 |
| Gas-Electric and By-Products Recovery Plant at the Accrington Electricity Works (*illus.*) | 259 |
| Some Results of Over-Production | 263 |
| Notes | 266 |
| City Notes | 268 |
| Stocks and Shares | 269 |
| Electric Tramway and Railway Traffic Returns | 270 |
| Market Quotations | 270 |
| Share List of Electrical Companies | 271 |
| The Billiter-Siemens Electrolytic Alkali Cell and Process (*illus.*) | 273 |
| Notes on Buying | 276 |
| Reviews | 278 |
| Foreign and Colonial Tariffs on Electrical Goods | 280 |
| New Patents Applied For, 1913 | 280 |
| Abstracts of Published Specifications | 280 |
| Contractors' Column | Advertisement pages xxii and xxiv |

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## LABOUR AGREEMENTS.

THERE was issued a short time ago in the form of a Blue Book the report of the Industrial Council upon the inquiry which they undertook at the request of the Government into matters relating to industrial agreements. The questions to which their attention had been specially directed were (1) What is the best method of securing the due fulfilment of industrial agreements? (2) How far, and in what manner, should industrial agreements which are made between representative bodies of employers and of workmen be enforced throughout a particular trade or district?

Surely no committee ever had a more difficult question to answer than that first above written.

Your Conciliation Board can draw up an agreement; can seal it with many seals, and obtain the signatures of numerous representatives of employers and men. But there its power ends. Like a court of justice, it can give judgment, but it has no power to enforce the judgment. What is it that makes the decrees of our courts of civil jurisdiction respected? The strong arm of the law seldom has to be used to compel anyone to do anything. If a man has a judgment entered against him, he pays up. If he is enjoined by the Court of Chancery to cease doing something to the discomfort of his neighbour, he obeys the injunction, and pays the costs. He does these things partly out of respect for the law and partly because he knows he can be made to do them, whether he is willing or not.

When the body politic, limiting that term for the nonce to all that is comprised in the phrase "Capital and Labour," is suffering from any complaint, it is the fashion to call in a consulting physician. His name is Industrial Arbitration. He never acts hastily; he considers the case in hand from every point of view. Eventually he writes a prescription or lays down rules for the guidance of his patient. At this point, however, his powers fail. He cannot make his patient conform to his wishes or obey his decrees. The patient can throw the medicine down the sink; or (abandon the metaphor) the workman can wholly disregard the finding of any Court of Arbitration and adopt the down-tool policy.

It is for this reason that one approaches the findings of each fresh Conciliation Board, or Court of Industrial Arbitration, with a feeling akin to disheartenment. The noise of industrial warfare may, for the time, have receded into the distance; but when the present period of trade prosperity draws to a close we shall inevitably hear these noises once more. How would the Industrial Council, the result of whose deliberations we are discussing, propose to secure the observance of the industrial agreement? Let us see what the Council have found and what they recommend. In the first place, they find that agreements between capital and labour have been as a rule kept. We could mention a good many instances wherein they have been disregarded by the men, but this by the way. That the Council recognise

that there can be such a thing as a breach of an agreement appears from their recommendation that no assistance, financial or otherwise, should be given by any association to members breaking an agreement.

The recommendations of the Council may be summarised as follows:—They would have an interpretation clause in every industrial agreement to enable disputes to be decided. While not approving compulsory arbitration, they would approve the adoption of means whereby a dissentient minority, whether of employers or men, could be compulsorily made parties to a conciliation agreement. The Board of Trade, if satisfied after due inquiry that a particular agreement affects the particular trade, should have power to order that "the terms of the agreement, with such modifications as may be agreed, shall be extended to cover the whole of the trade or district. Where an agreement has been so declared to be extended, it shall be an implied term of any contract of service in the particular trade of district that the terms of the agreement shall be an essential part of such contract."

We have said enough to show that the result of the Council's deliberations is marked by a serious inconsistency. While declaring piously against compulsion at one stage, they declare for it at another, on the principle, we suppose, that minorities must suffer. If a particular employer desires to carry on his business in his own way he is not to be allowed to do so; but agreements may be broken with comparative impunity, so far as the men are concerned. We do not favour that ridiculous anachronism—compulsory arbitration; far from it. But we do protest against a form of compulsion which is designed to bring pressure upon employers. That the Committee were by no means unanimously supporting this proposal, appears from the fact that Mr. Siemens did not give his sanction to the report as a whole, while Mr. Ainsworth, Sir Hugh Bell, Mr. Clowes, Mr. Davis, Mr. Devith and Mr. Robert Thompson express their dissent from the proposals of the report so far as they relate to the extension of agreements.

Upon the whole, therefore, this report does not lead us very much further upon the road which leads to industrial peace. Nor are we surprised that the deliberations of the Council are comparatively barren in result.

Ever since the fateful hour when the Legislature began to interfere between employer and workmen, the prospect of agreement by consent has been fading into the distance. The culminating measure in a whole series of disastrous Acts of Parliament was the Trades Disputes Act. Until that measure is removed from the Statute Book we see no prospect of employers falling in with these proposals for settlement by agreement.

**Gas-Electrical Plant at Accrington.**

The Mond gas producer and by-product recovery plant, which has been in use during the past nine months at the Accrington Corporation Electricity Works, and which we describe elsewhere in this issue, marks a development in municipal central station practice which will be watched with the keenest interest by central station men in this country. As in the case of the West Hartlepool Corporation's exhaust steam plant, described in our issue of August 1st, it is a novelty, in so far as its municipal ownership is concerned, and is equally welcome as another sign of enterprise on the part of the municipal electrical fraternity.

The critical discussions which took place, in the early part of 1909, on Messrs. Andrews & Porter's I.E.E. paper on the use of large gas engines for generating electricity, brought this matter prominently before central station engineers, and in view of the division of opinion for and against the gas engine, the results which accrue from the Accrington installation in the next year or two should form a valuable appendix to the above paper, despite the discrepancy in the size of the installation considered by Mr. Andrews and that installed at Accrington.

Although the Accrington engines are not "large" in comparison with Continental examples running on furnace gas, yet they operate under most favourable conditions as regards load factor, both steam and battery plant being available for peak loads; the fuel used in the producers is a local bituminous coal costing 13s. 6d. per ton and the net result in practice, allowing, say, 1½ lb. fuel per KW.-hour, would appear to be an average fuel cost of ·05d. per unit—a figure which leaves a substantial margin on which to argue the respective merits of gas and steam plant.

We believe that the bituminous producers have given every satisfaction, and that this applies to the plant generally, which, moreover, with further experience of its working, may not unnaturally be expected to yield better results in the direction of by-products. This is a matter of considerable importance at the present day, in view of the noticeable effect which the increased cost of coal has had on the working of modern steam plant, and must be taken into account when considering the respective first costs of the two classes of plant.

Mr. Gray, the borough electrical engineer, has, at any rate, satisfied himself as to the suitability of his plant for meeting the conditions obtaining at Accrington, and we should not be surprised to hear of its being considerably extended in the near future.

**Hydro-Electric Works in Norway.**

It is announced from Christiania that the Parliament of Norway has passed, by a large majority, a Bill whereby the right of utilising the water-power of the Aura fall in the district of Romsdal is granted to an English company. The latter, in return for the concession, is to make a single payment of £27,400 to the State and the Commune of Romsdal, together with a standing payment of 1 crown (1s. 1¼d.) per H.P. used. The expenditure on the works is estimated at £2,197,000.

It is calculated that the water-powers usefully employed will shortly amount to 250,000 H.P., which can easily be raised to 700,000 H.P., although it is declared that the numerous waterfalls in Norway would be able to yield 10,000,000 H.P. The country itself is declared by many persons not to be rich enough to undertake the exploitation of the waterfalls, and native capitalists also do not come forward, because the State reserves the right of reversion, and even proposes to extend the right. For instance, after a lapse of 30 to 60 years all water-powers acquired by private individuals revert by law to the State without the payment of any compensation. The representatives of the wealthy section of the community contend that the right of reversion should only apply to foreign capital, but the Government has stated that no difference in the matter shall be made as between native and foreign capitalists. It is considered that the grant of the concession to the English company will cause Norwegian capitalists to bestir themselves as they will be unwilling merely to look on while the native water powers gradually pass into foreign ownership, as is now proceeding, seeing that French and German capital is already largely invested in two districts in the country.

**Central Station Advertising.**

There are signs that central stations are becoming keenly alive to the fact that their business has a commercial side, and they are devoting each year more time and money to advertising. Although much has been done, there is, as we have frequently stated, room for greater energy in this direction. It has been said that a central station's business can be defined as the selling of profitable service, and, as with everything else, before this can be sold, the public who are to become customers must be made to understand what it is they are being asked to buy, and in what way they will be benefited by the purchase. This can only be done by advertising, the methods of which can be divided roughly into two classes, viz., printed advertisement, and that gained by personal contact with actual and prospective users of electricity. It has been laid down, with much truth, that the latter form consists of courtesy to the public at every point of contact, periodical visits to customers in order to solicit criticism and forestall complaints, prompt and cheerful

attention to such complaints as are received, and, as an American would put it, "delivering the goods." It matters little how alluring printed advertisements may be, if the customer is treated brusquely or with scant courtesy whenever he comes into contact with an employé of the station. Everyone connected with the business is a medium through which it can be advertised by courtesy and efficiency.

The success of a central station from a commercial standpoint is in direct ratio to the effectiveness of the service it gives. The public recognises the fact, and demands and insists upon that service being rendered. If it is not, then it frequently goes elsewhere, and the goodwill of the station is impaired, the value of the plant is lessened, its development will cease, and a spirit of opposition to the organisation will be created. The goodwill of the public is perhaps the most valuable asset a station can possess, and it may be enormously developed by personal contact.

Many trans-Atlantic supply companies have formed a complaint department, but it is a moot point whether this is or is not wise. Possibly, with a very large undertaking, it is a good plan to engage a tactful and resourceful representative, whose business it shall be to deal with any member of the public who may have, or who considers he has, a grievance, though it would be unwise to give that name to his department. But no matter by whom complaints are received, it is necessary to remember that the manner in which they are dealt with is of vital importance to the well-being of the station from the point of view of advertisement.

Printed advertisements are of a different nature, and it is well to avoid the personal as far as possible in these; the English character instinctively shrinks from the personal element in an advertisement. The direct form of advertising, in which circulars, leaflets and pamphlets are sent direct to clients, or those whom it is hoped will become customers, is undoubtedly the most useful form that can be adopted. Newspaper advertising is in this connection seldom of great value. If the reading public are keenly interested in the affairs of the central station, a well-written and attractive advertisement may have a certain amount of pulling power, but usually money spent in this way might be employed to better advantage. The case is, of course, different as regards appliances for the domestic use of electricity. Fans, radiators and cooking apparatus can readily be sold through the medium of the local Press, but the general consensus of opinion is that electric signs, and tramcar and omnibus advertising are more useful to a supply authority. Electric signs in particular are of great value, as showing that the station practises what it preaches. It would appear, from a close study of the subject, that whilst all publicity is worth money to the station, the best way in which it can be obtained is by making certain that the service rendered is of as nearly as possible 100 per cent. efficiency, and by coming into as direct and personal a contact with prospective clients as is humanly possible.

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**The Wireless Contract.**

Last Friday, by a division which unfortunately was made to follow party lines, the agreement between the Government and Marconi's Wireless Telegraph Co., for the erection of the chain of Imperial wireless stations was approved by the House of Commons. The matter may, therefore, be considered at an end so far as its political aspect is concerned, and we may look forward to the speedy execution of the contract and the provision of a valuable auxiliary to the network of cables which binds together the scattered members of our vast Empire. We cannot but regret that it ever, through Ministerial indiscretions, became the subject of political controversy at all, being inherently a matter that should be judged only from the highest standpoint of patriotism, with a view to securing the greatest possible benefit to the nation and the Empire. One of the most regrettable features of the party system is its essential hypocrisy; thus the Postmaster-General was bitterly attacked because he would not consent to further delay—had he delayed, however, he would have been no less violently abused for imperilling the safety of the Empire to save a few paltry thousands!

The opposition, as it happened, was all at sixes and sevens on this question, and thus failed to produce any notable result. For instance, Sir Henry Norman, who has seen "every big station in Europe" (but has he seen one big Marconi station?) and is thus eminently qualified to lay down the law on wireless telegraphy, based his opposition on a denial of urgency, while Mr. Bonar Law admitted urgency; the former admitted that the construction of the stations by the Government, which he advocated, would be much more costly than the Marconi contract—the latter, as well as Lord Robert Cecil, declared his belief that the Government would save money by dispensing with the company's services.

Lord Robert Cecil considered the new contract better for the company than the old one—Sir G. C. Marks showed in detail a number of points in which the new contract was less favourable to the company than the first one. It was hardly surprising, therefore, that the only members of the ruling party who voted against the Government were those abovementioned, who had committed themselves to the policy of construction by the State.

There is one feature, we believe, common to all the speeches in the debate, and frequently put forward in discussions outside the Palace of Westminster—namely, the statement that the art of wireless telegraphy is in a state of rapid development and change. We do not dispute the fact that the industry is in a transitional state—that is common knowledge; but we must enter a protest against the belief that it is undergoing the excessively rapid changes alleged by some of the disputants, especially those least acquainted with the technicalities of the question. We are repeatedly urged to wait and see what a month or two will bring forth. Now, anyone who is familiar with the history of wireless telegraphy must be aware that each important step in advance has cost not months, but years of assiduous development and research; Mr. Marconi himself, although he succeeded in hearing faint signals across the Atlantic in 1901, was not able to commence a commercial service until 1908, and had to abandon it again until 1910. In 1907 the Poulsen company announced its ability to provide a trans-Atlantic service—to this day it has not a single long-distance service at work day and night on commercial lines. The Goldschmidt company is in a similar position. The various rivals of the Marconi company are still, as heretofore, *going to do* something which they have not yet done, and while we do not doubt that they will eventually succeed, we are not prepared to believe that vast changes will take place in the course of one or two months, or even six months. Let it be remembered that the Marconi contract has been on the table for over 12 months already; if others have not been able to prove their ability to achieve the desired end within the past 12 months, why should we anticipate their triumph within "a month or two"?

In this connection we observe, with regret, that an esteemed contemporary makes a distinction between "urgency" and "extreme urgency," and advocates a policy of delay, with a view to the formation of a State department—although it also urges, contradictorily, that "the field for radio-development should be left untrammelled by the heavy hand of the State . . . the most deadening form of tutelage conceivable." The writer uningenously refers to periods of "a few months", allowed by the Postmaster-General for the Poulsen and Goldschmidt companies to demonstrate the capabilities of their respective systems in support of his denial of urgency, not disclosing the fact that the P.M.G. offered to consider these systems *for the second three stations* if proved suitable within a few months, and refused to delay the first three a moment longer than was unavoidable.

Numerous questions arise in connection with the agreement and the other papers recently issued in relation to the contract, but we cannot discuss them in detail here; suffice it to say that, when all the circumstances are taken into consideration, we believe that the course which has been followed by the Government and approved by the House of Commons is that which tends to the best interests of the Empire, and that we do not anticipate any reason for regretting the present decision.

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## THE VEHICLE CHARGING LOAD: A CANADIAN OUTLOOK.

A paper by Mr. C. Rummel on this subject appearing in the *Canadian Electrical News* last month, contained some observations of interest at the present moment to British supply engineers.

It would appear that the company with which Mr. Rummel is associated, although as a general principle preferring to leave the sale of apparatus to private contractors, has in this case been forced to deal directly with the consumers, as the electric vehicle business does not as yet offer sufficient attractions to dealers in petrol and steam cars to induce them to study the subject or undertake the trouble and expense of publicity work and providing garage facilities.

The author has found that where agencies are held for both petrol and electric vehicles by the same firms, the result is positively detrimental to the prospect of the latter, owing to the extra selling effort called for to introduce an article which is comparatively new and untried both to the buyer and the seller.

It may also be assumed that the superiority of the "electric" in regard to cost of repair, maintenance, and its consumption of lubricants and sundries does not commend it to the seller of the more complicated engine-driven vehicle, who naturally looks for any legitimate maintenance business which may arise after the sale is completed.

It is of interest to note that the first "electric" is said to have been sold in Vancouver seven years ago, and, in spite of deficient facilities and knowledge for its proper treatment, the vehicle (a 5-ton truck) is in successful use to-day.

As a result of the slow progress made by the "electric" in the district, the supply undertaking decided at the beginning of the present year to undertake the sale and care of battery-driven vehicles, making the best possible publicity move by purchasing three trucks for its own use. These were employed for meter, arc lamp and overhead line work, and proved satisfactory under exceptional conditions of snow and bad weather.

An assistant with experience in selling electric cars was engaged, and a considerable amount of Press advertising undertaken. Since February an active campaign has been in operation on the usual lines, the company, in addition, offering the use of its own vehicles on trial to carry out delivery work for firms interested in the matter.

In about four months three trucks have been sold by the company and two by private dealers, whilst great interest in the subject has been aroused which, although, no doubt, a satisfactory beginning, only confirms experience on this side to the effect that the early development of this business will be slow, and that those who believe in its future must have the courage to undertake a considerable amount of work and expenditure.

The writer draws attention to the desirability of purchasing standard chassis from the manufacturer, and having bodies fitted to the buyer's wishes by van builders on the spot, which makes for satisfaction in detail, and arouses local interest.

The need of suitable garage accommodation and attention for those who were only able to use one or two vehicles was soon experienced, and the electricity undertaking is now putting up a suitable building in the centre of the city.

From the few figures given it would appear that this establishment will have sufficient space for about 20 trucks to be charged, cleaned and manœuvred; assuming that the bulk of the charging business is done in the night, it may be taken that this garage will be found sufficient to meet the needs of a fleet of 30 vans in daily use in the city.

An estimate recently prepared for a garage of this capacity for an industrial borough in London gave the following approximate allocations of expenditure and revenue :—

| Expenditure. | £ | *Per unit.* | % | Revenue. | | |
|---|---|---|---|---|---|---|
| 1. Rent of land ... | 50 | ·036d. | 3·6 | 333,000 units at 1d. to cover cost of energy, attendance, accommodation and handling (no cleaning or repairs included) | £1,388 | 100 % |
| 2. Capital charges on buildings and machinery, at 10 per cent. ... | 150 | ·108d. | 10·8 | | | |
| 3. Labour ... ... | 250 | ·180d. | 18·0 | | | |
| 4. Electrical energy at cost, 333,000 units at ·5d. ... | 694 | ·500d. | 50·0 | | | |
| 5. Profits ... ... | 244 | ·176d. | 17·6 | | | |
| | £1,388 | 1·000d. | 100·0 | | £1,388 | 100 % |

The Canadian Co. is making inclusive monthly charges to cover electrical energy, storage, washing, oiling and minor adjustments, the figures rendered into English money being approximately as follows :—

| *Capacity of vehicle.* | *Charge per month.* |
|---|---|
| ½ ton ... ... ... ... ... ... | £9 |
| ¾ " ... ... ... ... ... ... | 9 |
| 1 " ... ... ... ... ... ... | 11 |
| 1¾ " ... ... ... ... ... ... | 12 |
| 3 1/10 " ... ... ... ... ... ... | 13 |
| 4½ " ... ... ... ... ... ... | 14 |

Allowing £500 per annum for the cleaning and attention not included in the English estimate, and taking the same number of vans, 30, at the average of the above charges, £11 per month, a figure of £3,460 per annum is obtained as the comparative revenue, and after allowing for the higher charges on buildings and machinery which would probably obtain in Canada, it may be fairly deduced that the allowance for energy alone in the above charges is of the order of 1½d. per B. of T. unit.

Although the local garage owners have shown reluctance to take up the commercial vehicle, it appears that they do a considerable business in private pleasure cars.

These small vehicles are stored, washed, charged and oiled for a monthly charge of about £6 each, which in some cases includes delivery and collection of the vehicle.

It is stated that in the province of British Columbia there are in use 100 pleasure cars and 12 commercial trucks.

Further business done in Victoria and Vancouver in the period mentioned includes two trucks of 2 tons capacity and one of 5 tons.

The author refers at some length to the desirability of the charging load from the point of view of the central station, pointing out that to a great extent distribution costs are done away with, whilst the load for the most part is taken after 9 or 10 o'clock in the evening with the exception of a certain amount of boosting at midday.

Apparently the Canadian central stations have now become fully alive to the possibilities of the "electric" and the rates quoted for charging are entirely satisfactory from the point of view of competition either with horse traction or petrol cars.

The first cost of the vehicle, however, appears to constitute a great difficulty. Five-ton trucks, f.o.b. Vancouver are quoted at £1,500. A 750-lb. electric delivery wagon is quoted at £500, as against a petrol wagon at £160.

The author points out the difficulty which the salesman has in convincing the consumers that in spite of the great differences in first cost, a saving may be effected by buying the "electric."

Apparently, they claim that the saving is to a great extent due to the low price quoted for electrical energy. It would appear, however, from an examination of the costs submitted, that electrical energy accounts for a comparatively small percentage of the cost of operating, and unless the price per unit is unduly high, it does not become a determining factor in competition with petrol or steam.

On this side, those who have done any work in this direction, have already arrived at the conclusion that 1d. per unit is quite a reasonable charge, and that there is no necessity to go lower excepting under special conditions, the more

pressing need being some unified system of rating all over the country, and the provision of ample charging facilities.

These conditions will be the more easily brought about if a reasonable return is obtained for the service given. The whole question is one which at the present time deserves the attention of all supply authorities.

## CORRESPONDENCE.

*Letters received by us after* 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Dry and Wet Air Filters.

With reference to the correspondence on the above subject, one or two points suggest themselves. Apart altogether from the practical difficulties which were fully discussed at the I.M.E.A. meeting, there are a few theoretical questions.

For instance, to what is the cooling due? Is it due to cold air or air plus water vapour? Or, again, is it due to cold air plus water vapour, together with water particles in a fine state of suspension? Having seen the turbo-generator at work at Brighton with the wet cooling appliance, I incline to the view that the cooling is due to water particles absorbing their latent heat of evaporation, together with increased specific heat due to humidity and, of course, the temperature drop.

If this view is correct, it would appear that cloth filtration by abstracting the water or mist particles neutralises a great advantage, and will never compete with wet cooling for generator cooling purposes. Calculation shows that the drop in temperature and raised specific heat due to humidity does not appear to account for everything, and therefore one is forced to conclude that water or mist particles are also present. If evaporation of mist particles at wet bulb temperature is occurring to any extent, then there is no question that a smaller plant is required in the wet process.

It would be interesting to learn the views of others on this question.

**W. H. F. Murdoch.**

Millhill, *August 8th*, 1913.

### Systems of Wages Payment and "Scientific Management."

Your contributor, "Zähler," falls into the not uncommon error of speaking of "scientific management" as though it were merely a system of wages payment. Various piecework and bonus systems of payment have been employed in connection with what is known as "scientific management," but there is nothing specially novel about these systems of payment in themselves, and they are merely employed as necessary incentives to induce the workpeople to keep up to the standards set by the methods of scientific management. If it were claimed that the remarkable results obtained with scientific management were due simply to a method of wage-payment, such claims might well be regarded as exaggerated, but the particular method of wage-payment used is only one detail of the whole scheme of scientific management, with which remarkable results have unquestionably been obtained.

It is easy to make fun of Parkhurst's office-cleaner's schedule, and it is easy, too, to over-systematise. No sensible person imagines that "any system can take the place of an intelligent and zealous staff." But does it follow that no system is of any use? Without good men nothing can be done; but, surely, a good system of management will enable your intelligent and zealous staff to effect a great deal more than they could do without its assistance?

**G. C. Allingham.**

London, N.W., *April 11th*, 1913.

### Shift Engineers.—A Proposal.

I have often wondered at the non-invasion of central station work by the fair sex. I cannot recollect ever having seen one employed even in the clerical department of electricity works.

But for reading the letter by Dr. Larmor in the *Times*, in which he states how men from other occupations would be required for wireless telegraph stations, I should have had some misgivings in broaching the subject at all. However, should station men desire to take up this branch of electrical work, they would be more fitted for it than men from many other occupations.

Taking switchboard work into consideration to begin with, I believe, this occupation is pre-eminently one for the fair sex, especially for those who have had the advantage of higher education and some laboratory experience in the physics department. And what veritable godsends they would be in some stations!

In engine-room work the men appear to have to spend more than half their time doing work which could be done as efficiently, expeditiously, and more economically, by charwomen. And it is a well-known fact that many of the enclosed type of high-speed engines and turbines require practically very little attention, so that here again, one can see opportunities for the fair sex to step in, and, with little training, to perform the duties well.

Yet again, even in the boiler house, with mechanically fed hoppers, &c., those of strong physique would be capable of holding their own!

And I am by no means sure that the fair sex, in a short time, would not be able to give many a shift engineer points, and beat him. And managers would have to look to their laurels.

In Government plants where engineers, no doubt, have some nice soft sinecures, what delectable plums there would be for some fair operators to choose from, and they would, no doubt, efficiently perform what little duties would be required of them in a very short time.

**W. E. Pritchard.**

*August 11th*, 1913.

## SOME NEW FORMS OF RECORDING INSTRUMENTS.

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Another requirement, for the sake of symmetry in the switchboard arrangements, is that all the instruments, whether recording voltmeters, recording wattmeters, recording double wattmeters or other types, shall have the same outside appearance and dimensions and the method of handling all of them when changing the record sheet must be the same.

From the manufacturers' point of view, this uniformity should extend much further than merely as regards these outside details, for only by the utmost standardisation of working parts can recording instruments, of which comparatively few are required, be produced at reasonable prices.

In order to meet these requirements, Messrs. Hartmann and Braun have recently introduced a new form of recording instrument, some particulars of which recently appeared in the *E.T.Z.*

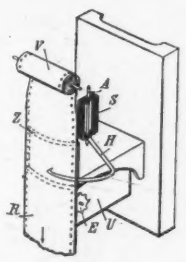


Fig. 1.

The recording arrangement adopted in these is shown in fig. 1 diagrammatically. The working axis A is vertical and parallel to the base plate. Co-axial with A, a cylindrical plate Z is placed, over which the hook-shaped pointer H moves from side to side. The record sheet is carried on a roll at V, and is drawn at a steady speed over the cylindrical plate by means of the spiked wheels E, driven by clockwork. Special clips serve to spread the paper smoothly against the cylindrical surface. The end of the pointer carries a pen and a rectangular co-ordinate record is thus obtained, in spite of the fact that the moving system has the ordinary circular motion.

## THE VEHICLE CHARGING LOAD: A CANADIAN OUTLOOK.

A paper by Mr. C. Rummel on this subject appearing in the *Canadian Electrical News* last month, contained some observations of interest at the present moment to British supply engineers.

It would appear that the company with which Mr. Rummel is associated, although as a general principle preferring to leave the sale of apparatus to private contractors, has in this case been forced to deal directly with the consumers, as the electric vehicle business does not as yet offer sufficient attractions to dealers in petrol and steam cars to induce them to study the subject or undertake the trouble and expense of publicity work and providing garage facilities.

The author has found that where agencies are held for both petrol and electric vehicles by the same firms, the result is positively detrimental to the prospect of the latter, owing to the extra selling effort called for to introduce an article which is comparatively new and untried both to the buyer and the seller.

It may also be assumed that the superiority of the "electric" in regard to cost of repair, maintenance, and its consumption of lubricants and sundries does not commend it to the seller of the more complicated engine-driven vehicle, who naturally looks for any legitimate maintenance business which may arise after the sale is completed.

It is of interest to note that the first "electric" is said to have been sold in Vancouver seven years ago, and, in spite of deficient facilities and knowledge for its proper treatment, the vehicle (a 5-ton truck) is in successful use to-day.

As a result of the slow progress made by the "electric" in the district, the supply undertaking decided at the beginning of the present year to undertake the sale and care of battery-driven vehicles, making the best possible publicity move by purchasing three trucks for its own use. These were employed for meter, arc lamp and overhead line work, and proved satisfactory under exceptional conditions of snow and bad weather.

An assistant with experience in selling electric cars was engaged, and a considerable amount of Press advertising undertaken. Since February an active campaign has been in operation on the usual lines, the company, in addition, offering the use of its own vehicles on trial to carry out delivery work for firms interested in the matter.

In about four months three trucks have been sold by the company and two by private dealers, whilst great interest in the subject has been aroused which, although, no doubt, a satisfactory beginning, only confirms experience on this side to the effect that the early development of this business will be slow, and that those who believe in its future must have the courage to undertake a considerable amount of work and expenditure.

The writer draws attention to the desirability of purchasing standard chassis from the manufacturer, and having bodies fitted to the buyer's wishes by van builders on the spot, which makes for satisfaction in detail, and arouses local interest.

The need of suitable garage accommodation and attention for those who were only able to use one or two vehicles was soon experienced, and the electricity undertaking is now putting up a suitable building in the centre of the city.

From the few figures given it would appear that this establishment will have sufficient space for about 20 trucks to be charged, cleaned and manœuvred; assuming that the bulk of the charging business is done in the night, it may be taken that this garage will be found sufficient to meet the needs of a fleet of 30 vans in daily use in the city.

An estimate recently prepared for a garage of this capacity for an industrial borough in London gave the following approximate allocations of expenditure and revenue :—

| Expenditure. | £ | *Per unit.* | % | Revenue. | |
|---|---|---|---|---|---|
| 1. Rent of land ... | 50 | ·036d. | 3·6 | 333,000 units at 1d. to cover cost of energy, attendance, accommodation and handling (no cleaning or repairs included) | |
| 2. Capital charges on buildings and machinery, at 10 per cent. ... | 150 | ·108d. | 10·8 | | |
| 3. Labour ... ... | 250 | ·180d. | 18·0 | £1,388 | 100 % |
| 4. Electrical energy at cost, 333,000 units at ·5d. ... | 694 | ·500d. | 50·0 | | |
| 5. Profits ... ... | 244 | ·176d. | 17·6 | | |
| | £1,388 | 1·000d. | 100·0 | £1,388 | 100 % |

The Canadian Co. is making inclusive monthly charges to cover electrical energy, storage, washing, oiling and minor adjustments, the figures rendered into English money being approximately as follows :—

| *Capacity of vehicle.* | *Charge per month.* |
|---|---|
| ⅓ ton ... ... ... ... ... ... | £9 |
| ½ „ ... ... ... ... ... ... | 9 |
| $\frac{9}{10}$ „ ... ... ... ... ... | 11 |
| 1¾ „ ... ... ... ... ... | 12 |
| 3$\frac{1}{10}$ „ ... ... ... ... ... | 13 |
| 4½ „ ... ... ... ... ... ... | 14 |

Allowing £500 per annum for the cleaning and attention not included in the English estimate, and taking the same number of vans, 30, at the average of the above charges, £11 per month, a figure of £3,460 per annum is obtained as the comparative revenue, and after allowing for the higher charges on buildings and machinery which would probably obtain in Canada, it may be fairly deduced that the allowance for energy alone in the above charges is of the order of 1½d. per B. of T. unit.

Although the local garage owners have shown reluctance to take up the commercial vehicle, it appears that they do a considerable business in private pleasure cars.

These small vehicles are stored, washed, charged and oiled for a monthly charge of about £6 each, which in some cases includes delivery and collection of the vehicle.

It is stated that in the province of British Columbia there are in use 100 pleasure cars and 12 commercial trucks.

Further business done in Victoria and Vancouver in the period mentioned includes two trucks of 2 tons capacity and one of 5 tons.

The author refers at some length to the desirability of the charging load from the point of view of the central station, pointing out that to a great extent distribution costs are done away with, whilst the load for the most part is taken after 9 or 10 o'clock in the evening with the exception of a certain amount of boosting at midday.

Apparently the Canadian central stations have now become fully alive to the possibilities of the "electric" and the rates quoted for charging are entirely satisfactory from the point of view of competition either with horse traction or petrol cars.

The first cost of the vehicle, however, appears to constitute a great difficulty. Five-ton trucks, f.o.b. Vancouver are quoted at £1,500. A 750-lb. electric delivery wagon is quoted at £500, as against a petrol wagon at £160.

The author points out the difficulty which the salesman has in convincing the consumers that in spite of the great differences in first cost, a saving may be effected by buying the "electric."

Apparently, they claim that the saving is to a great extent due to the low price quoted for electrical energy. It would appear, however, from an examination of the costs submitted, that electrical energy accounts for a comparatively small percentage of the cost of operating, and unless the price per unit is unduly high, it does not become a determining factor in competition with petrol or steam.

On this side, those who have done any work in this direction, have already arrived at the conclusion that 1d. per unit is quite a reasonable charge, and that there is no necessity to go lower excepting under special conditions, the more

pressing need being some unified system of rating all over the country, and the provision of ample charging facilities.

These conditions will be the more easily brought about if a reasonable return is obtained for the service given. The whole question is one which at the present time deserves the attention of all supply authorities.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Dry and Wet Air Filters.

With reference to the correspondence on the above subject, one or two points suggest themselves. Apart altogether from the practical difficulties which were fully discussed at the I.M.E.A. meeting, there are a few theoretical questions.

For instance, to what is the cooling due? Is it due to cold air or air plus water vapour? Or, again, is it due to cold air plus water vapour, together with water particles in a fine state of suspension? Having seen the turbo-generator at work at Brighton with the wet cooling appliance, I incline to the view that the cooling is due to water particles absorbing their latent heat of evaporation, together with increased specific heat due to humidity and, of course, the temperature drop.

If this view is correct, it would appear that cloth filtration by abstracting the water or mist particles neutralises a great advantage, and will never compete with wet cooling for generator cooling purposes. Calculation shows that the drop in temperature and raised specific heat due to humidity does not appear to account for everything, and therefore one is forced to conclude that water or mist particles are also present. If evaporation of mist particles at wet bulb temperature is occurring to any extent, then there is no question that a smaller plant is required in the wet process.

It would be interesting to learn the views of others on this question.

**W. H. F. Murdoch.**

Millhill, *August 8th*, 1913.

### Systems of Wages Payment and "Scientific Management."

Your contributor, "Zähler," falls into the not uncommon error of speaking of "scientific management" as though it were merely a system of wages payment. Various piecework and bonus systems of payment have been employed in connection with what is known as "scientific management," but there is nothing specially novel about these systems of payment in themselves, and they are merely employed as necessary incentives to induce the workpeople to keep up to the standards set by the methods of scientific management. If it were claimed that the remarkable results obtained with scientific management were due simply to a method of wage-payment, such claims might well be regarded as exaggerated, but the particular method of wage-payment used is only one detail of the whole scheme of scientific management, with which remarkable results have unquestionably been obtained.

It is easy to make fun of Parkhurst's office-cleaner's schedule, and it is easy, too, to over-systematise. No sensible person imagines that "any system can take the place of an intelligent and zealous staff." But does it follow that no system is of any use? Without good men nothing can be done; but, surely, a good system of management will enable your intelligent and zealous staff to effect a great deal more than they could do without its assistance?

**G. C. Allingham.**

London, N.W., *April 11th*, 1913.

### Shift Engineers.—A Proposal.

I have often wondered at the non-invasion of central station work by the fair sex. I cannot recollect ever having seen one employed even in the clerical department of electricity works.

But for reading the letter by Dr. Larmor in the *Times*, in which he states how men from other occupations would be required for wireless telegraph stations, I should have had some misgivings in broaching the subject at all. However, should station men desire to take up this branch of electrical work, they would be more fitted for it than men from many other occupations.

Taking switchboard work into consideration to begin with, I believe, this occupation is pre-eminently one for the fair sex, especially for those who have had the advantage of higher education and some laboratory experience in the physics department. And what veritable godsends they would be in some stations!

In engine-room work the men appear to have to spend more than half their time doing work which could be done as efficiently, expeditiously, and more economically, by charwomen. And it is a well-known fact that many of the enclosed type of high-speed engines and turbines require practically very little attention, so that here again, one can see opportunities for the fair sex to step in, and, with little training, to perform the duties well.

Yet again, even in the boiler house, with mechanically fed hoppers, &c., those of strong physique would be capable of holding their own!

And I am by no means sure that the fair sex, in a short time, would not be able to give many a shift engineer points, and beat him. And managers would have to look to their laurels.

In Government plants where engineers, no doubt, have some nice soft sinecures, what delectable plums there would be for some fair operators to choose from, and they would, no doubt, efficiently perform what little duties would be required of them in a very short time.

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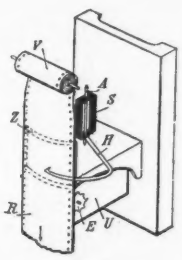



Fig. 1.

The recording arrangement adopted in these is shown in fig. 1 diagrammatically. The working axis A is vertical and parallel to the base plate. Co-axial with A, a cylindrical plate Z is placed, over which the hook-shaped pointer H moves from side to side. The record sheet is carried on a roll at V, and is drawn at a steady speed over the cylindrical plate by means of the spiked wheels E, driven by clockwork. Special clips serve to spread the paper smoothly against the cylindrical surface. The end of the pointer carries a pen and a rectangular co-ordinate record is thus obtained, in spite of the fact that the moving system has the ordinary circular motion.

The arrangement lends itself to a compact construction, as can be seen from the side elevation in fig. 2.

The whole front of the instrument is formed by a glass door, which enables the record to be clearly seen. After passing the pointer, the paper is either allowed to pass down out of the instrument through a slot, or it is automatically wound on to a second drum. The metal clamp in front of the paper, carrying the scale, &c., can be readily moved to one side by a small handle. When so moved, it carries the pointer with it, and leaves the whole front of the paper clear, and ready for removal or renewal.

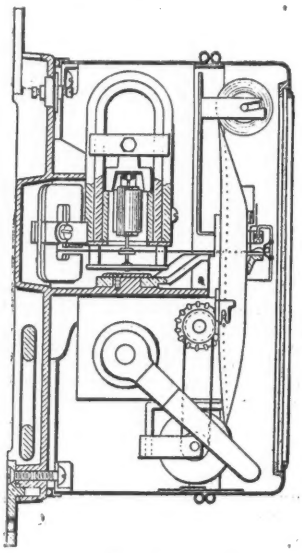


FIG. 2.

The clockwork mechanism is especially powerful, and runs for one month with the normal paper speed of 60 mm. per hour. The spiked driving wheels are geared to the clockwork by an external pair of wheels, whose ratio can be readily altered when desired, so as to change the speed of the record up to as much as 10 mm. per second. The whole of the clockwork can also be bodily removed and replaced by another when necessary.

The special pen arrangement used is shown in fig. 3; B is the paper clamp mentioned above, and over this the pointer moves with its indicator N in front of the scale S. A fork H on the end of the pointer carries the actual pen in the form of a capillary glass tube resting on knife edges, and with its upper end dipping into the removable ink trough T, which runs across the whole face of the paper. The action of the pen is similar to that in the Thomson siphon recorder, and the pen is balanced so that it presses lightly, but definitely, against the paper when moving rapidly. The liability of the fine glass tube to breakage is reduced by covering it with a coating of copper.

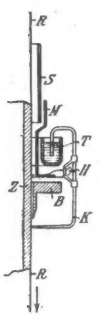



FIG. 3.

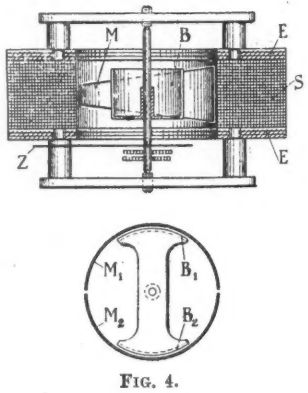



FIG. 4.

The arrangement has proved very satisfactory, and since the ink is not carried by the pointer, it is possible to provide enough for at least one month at one filling.

The meters are made up in three forms as regards outward construction:—(1) In a sheet metal case for mounting on the front of a board; (2) the same for mounting flush with the board; and (3) in a portable form for laboratory use, in a wooden case.

The instruments themselves are distinguished from ordinary indicating ones by having greater deflecting forces, so that the additional friction due to the pen becomes negligible. Magnetic damping is employed, as shown in fig. 2, the backward extension of the pointer serving both as counterweight and damping disk. The pointer comes to rest in from one to two seconds, but, if necessary, this time can be shortened.

Meters of the moving iron type are constructed, as shown in fig. 4. $M_1$, $M_2$ are two fixed wedge-shaped iron pieces, which repel the two moving pieces $B_1$, $B_2$, when both are magnetised by the coil S. This duplex arrangement serves to prevent all radical unbalanced forces. The former, on which the coil is wound, is made of sheet-iron E, so as to reduce the magnetic resistance.

Moving-coil instruments for direct-current work are especially suitable for rapid recording work, because of their light moving

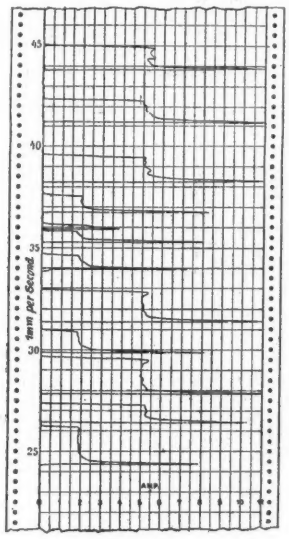



FIG. 5.

parts and large torque. Fig. 5 shows a current record obtained with one of these on a small crane motor with a paper speed of 1 mm. per second.

Hot-wire recording instruments are useful, because a single meter can be used correctly on D.C. or A.C. circuits, and with curves of any shape or frequency, and this reduces the number of instruments necessary—an important point with recording meters, whose cost is naturally greater than that of indicating ones.

The type used has a particularly constant zero, whilst at the same time it is comparatively quick acting.

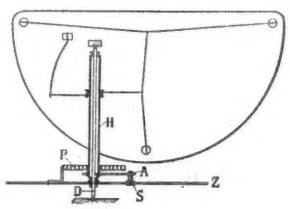



FIG. 6.

Since the pointer of recording instruments must be handled, and damage would result if the pointer of a hot-wire meter were moved over the full scale deflection with the wire in the cold state, a safety device has been introduced, as shown in fig. 6.

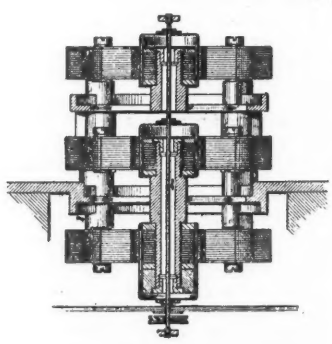


FIG. 7.

The pointer Z is not connected to the wire system rigidly, but through a flexible coupling. When working ordinarily the pointer is deflected by the arm A pressing against the peg S, but if the pointer is forcibly moved further along the scale than the existing wire extension demands, the inner spindle D moves in the hollow spindle H, and only subjects the wire system to quite safe forces through the spiral spring F. When the pointer is released the spring F brings back the peg S against the arm A.

Ferraris or induction instruments of the recording type are made up as ampere, volt and wattmeters, and only differ from the Hartmann & Braun indicating instruments of this type, in having a considerably greater torque. Fig. 7 shows a triple wattmeter of this type for use on four-wire, unbalanced three-phase systems. In spite of the height of this instrument it is still possible to get it into the standard size of case.

Fig. 8 shows a double wattmeter of the electro-dynamometer type, suitable for either D.C. or A.C. circuits. In these the fixed series coil is inside the moving (or volt) coil. Each system is surrounded, as shown, by a laminated iron cylinder, which serves to protect the coils from outside fields and to prevent interaction between the two wattmeters; this also reduces the magnetic

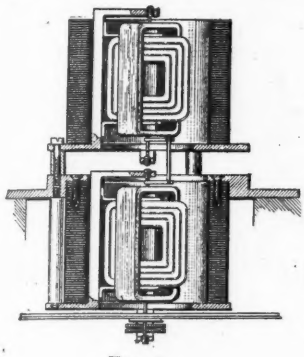


FIG. 8.

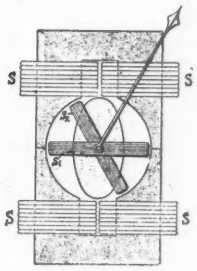



FIG. 9.

resistance and so improves the torque. At the same time the iron is so dimensioned that no appreciable error is introduced either by resonance on D.C. circuits or by the hysteresis effect on A.C. circuits.

The wattmeter scale divisions are perfectly uniform.

Fig. 9 shows a type of recording instrument, made up either as a phase meter or as a frequency meter. It is on the crossed coil principle, and by a suitable use of iron a large deflecting torque is obtained, sufficient to operate the pen even with very low currents in the mains. The readings are practically independent of current and voltage variations over a very wide range. When used as a frequency meter the connections are as shown in fig. 10. The

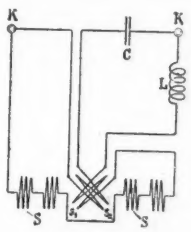



FIG. 10.

crossed coils $S_1$ and $S_2$ are mechanically connected together and have no external controlling force. One of them $S_1$ is connected through the fixed coils S and an inductive resistance L to the supply terminals K as a voltmeter. The other moving coil $S_2$ is connected to the same terminals through a condenser C. By carefully proportioning the fields due to S and $S_1$, the frequency readings can be made practically independent of the supply voltage and at the same time a uniform scale is obtained. A 50-cycle instrument will usually have a scale extending from 45 cycles to 55 cycles, or, if desired, from 40 cycles to 60 cycles, and covering the whole width of the paper.

## TRADE NAMES AND TRADE DESCRIPTIONS.

[BY OUR LEGAL CONTRIBUTOR.]

ALTHOUGH this subject has been dealt with on many previous occasions in the ELECTRICAL REVIEW, it is essentially a topic which merits discussion at repeated intervals. The statute law changes but slowly, but decisions in the Courts are very frequent. Unless the purport of the cases is clearly understood, a trader may be forced into long and expensive litigation.

Apart altogether from the law of trade-marks, the English Courts have, and will, exercise an inherent jurisdiction to prevent one trader adopting the title of another's goods with a fraudulent intent. Again, the law of England will restrain what is known as "passing off." Thus suppose the steel made by a particular firm were to become known throughout England as "Elephant Steel"—so well known that anyone buying "Elephant Steel" would know, or assume, that it was the product of the firm in question, and assume that, in these circumstances, another steel merchant were to stamp his bars with the words "Elephant Steel," the Courts would interfere to prevent his committing this fraud upon the public. This principle would be held to apply whether plaintiff or defendant was a foreigner trading in England. So it is apprehended that if an American firm of steel merchants had acquired what we may term a customary title to a certain name, their use of it would be protected. Again, if an English firm had acquired the right we have indicated, it would not be competent for the American firm to make infringing articles in America, and import them into England to deceive "His Majesty's subjects." Such a proceeding would be restrained and prevented, if the offenders could be got hold of

The fact that the misuse of a name will be prevented was well illustrated in the case of Aerators, Ltd. *v.* Automatic Aerator Patents, Ltd., which was heard by Mr. Justice Farwell early in June, 1903. There the plaintiff company, who are the proprietors of the well-known "Sparklets," sought to restrain the defendants from using the name "Automatic Aerator Patents, Ltd.," on the ground that it so nearly resembled the name of the plaintiff company as to be calculated to deceive. Sec. 20 of the Companies' Act provides that no company shall be registered under a name identical with that by which a subsisting company is already registered, or so nearly resembling the same as to be calculated to deceive, except in certain cases, which are not material to the present discussion. It follows from this that a company has greater rights than an individual in respect of names which are identical, for while John Smith cannot always prevent another John Smith using his own name, John Smith, Ltd., could prevent the registration of any other company as John Smith, Ltd. Mr. Justice Farwell, however, declined to grant an injunction, for the reason that, giving words their ordinary meaning, no one was likely to be deceived. Further, it was not competent for any company or person to claim the sole proprietorship of any word in common use. "For example," said his Lordship, "suppose a company had registered the name of 'Motors, Ltd.,' and another the name of 'Automobiles, Ltd.,' it appears to me impossible to say that they could thereby prevent all other companies from using as part of their titles these two words, which, so far as I know, are the only words which represent the fashionable locomotives of the day, although their sole trade was the manufacture or sale of motors or automobiles . . . In considering whether a name is calculated to deceive, it is, as I have said, material to see what that name is; and if the name is simply a word in ordinary use, representing a machine or an article of commerce, the probability of deception is out of all proportion less than it would be in the case of an invented or fancy word, or even of the name of a place."

Even if a man uses his own name in connection with his business, with intent to defraud, the Courts will prevent him.

In Holloway *v.* Holloway, 13 Beav. 209, the defendant, Henry Holloway, commenced selling pills as H. Holloway's pills in boxes similar to those of the plaintiff, Thomas Holloway, with a view to passing off his pills as the plaintiff's. He was restrained by injunction. Again, where a man named Day having obtained the authority of one Martin to use his name, set up in business as Day & Martin, and sold blacking in bottles with labels similar to those of the well-known firm, he was restrained by injunction. These two cases illustrate the proposition that "fraud vitiates everything." In the absence of fraud, however, a man may use his own name in his own business, no matter what may be the consequences to his neighbours. The case of Turton *v.* Turton may be regarded as a leading authority in support of this proposition. The plaintiffs had for many years carried on the business of steel manufacturers in Sheffield under the style of "Thomas Turton & Sons." In 1886 they were registered as a company, and added the word "Limited" to the above title. The defendants were John Turton and his two sons. John Turton had commenced a business very similar to that of the plaintiffs in 1869, in partnership with one Lawton, under the style of "Turton and Lawton." In 1875 Lawton retired, when John Turton took his sons into partnership under the style of "John Turton & Sons." Owing to the confusion caused by the similarity of names, the plaintiffs sought an injunction to restrain the defendants from carrying on the business of steel merchants and manufacturers under this name, or any name so closely resembling their own as to be calculated to deceive. Much evidence was called as to the confusion which had arisen in Sheffield, but the defendant deposed that the new name of his firm had been adopted for the sole purpose of making known the fact that his two sons had become partners. When the case reached the Court of Appeal, their Lordships refused to grant an injunction. The late Lord Esher said:—

"It is not alleged, and it certainly is not proved, that the defendant did anything in the way of his trade, which tended to give any other meaning to the name in which he carried on his business, or which could give any other meaning to it, than the mere fact that he did carry on his business, and was in partnership with his sons. The plaintiffs have no right to say a man may not use his own name. Upon principle I should say it is perfectly clear that if all a man does is to carry on the same business, and to state how he is carrying it on, that statement being the simple truth, and he does nothing more with regard to the respective names, he is doing no wrong, and there is no *prima facie* case against him."

It was held in a very recent case that the mere surname of an individual, though it may be adapted to distinguish the goods of all persons who bear that surname from the goods of other persons bearing a different surname, is not adapted to distinguish the goods manufactured by the applicant from those of other persons within Sec. 9 Sub.-sec. 5 of the Trade Marks Act, 1905. R. J. Lea, Ltd., Trade Mark, *Re* (C.A.) 29 T.L.R. 334.

The law on this subject may be thus summarised :—

1. A man will not be restrained from simply carrying on his business in his own name, even though confusion may arise.

2. A man will be restrained from carrying on business in his own name dishonestly, *i.e.*, when he not only uses his own name, but uses it in such a way (that is, in conjunction with other circumstances) as to represent that his business or his goods are the business or goods of another trader.

3. If a trader has a trade name for his goods which denotes those goods solely in the market, and distinguishes his goods from similar goods of other traders, so that the trade and the public, when asking for goods under that name, mean and intend to get particular goods emanating from one particular trade source (although they may not know such trader's name) then he is entitled to be protected by the Court against other traders using that name in such a way as to be calculated to pass off other goods as his.

The doctrine of "passing off" may also be illustrated by reference to numerous decisions. In one case, it was held that there was no monopoly in the use of the word "magnolia" as applied to metal, as it had become well known in the trade as a substance peculiarly adapted for bearings in machinery. Where, however, a brewer had manufactured ale at Stone for a number of years, so that his ale came to be known as "Stone ale," an injunction was granted to restrain the defendant, who had only recently come to the town, from selling ale under the appellation of "Stone ale," or "Montgomery stone ale" (Montgomery *v.* Thompson (1891), A.C., 217).

As a trade name is really acquired through the laches of the market, so, too, a trade name may be lost through the laches of the owner. If the owner of a trade name allows his rivals to use his trade name on their goods without objection, it will cease to be his trade name. It will become, in legal phraseology, *publici juris*, *i.e.*, common property. What is the test whereby to ascertain whether that which was originally a trade name has become *publici juris*, *i.e.*, common property? It becomes so when it ceases to be distinctive—when it ceases to denote solely the original man's goods in the market. Of course, it ceases to denote his goods solely if it is habitually used on similar goods by other traders. But this state of things—habitual use by other traders—can only arise with the acquiescence, *i.e.*, by the sanction, of the original trader. If, when he becomes aware that another or others are using his trade name he takes legal proceedings to stop that use, presumably he will succeed ; if he does not, then he will be held to have acquiesced in what is being done, and will be precluded from interfering afterwards. If, therefore, a trader becomes aware that his rights to his trade name are being invaded, he must take steps promptly to assert and protect those rights, if he wishes to preserve them, and he must not content himself with a mere protest, or even with a threat of legal proceedings ; but if the infringer sets him at defiance, he must follow up his threat with the proceedings he threatened.

In the generality of cases between trade rivals which come before the Courts, the plaintiff says :—"I complain that you have passed off your goods as mine, which they are not." In some cases, however, the plaintiff says :—"Your are passing off my goods as yours, which they are not." It seems that the Courts are inclined to prevent the latter form of piracy, just as much as they will prevent the former.

The case of Bullivant *v.* Wright (1897, 13, T.L., R. 201), illustrates what kind of passing off will be restrained by the Courts. The plaintiffs were wire-rope manufacturers and contractors for aerial tramways and cableways. The defendants, who were also wire-rope manufacturers, published a trade catalogue, which contained (*inter alia*) two diagrams, or pictures, of aerial cableways which had been designed and erected some years before by the plaintiffs' predecessors in title. The plaintiffs alleged that the publication of these diagrams by the defendants in their catalogue was a representation that the same had been erected by the defendants. They claimed an injunction to restrain the further publication of the catalogue, and an order for the delivery up of all the catalogues in existence. As a matter of fact, what the defendants had done was to supply new wire cables as they were required during several years. Mr. Justice Kekewich, in the course of his judgment, said : "No reasonable man, seeing these pictures in a book of this kind, would have any doubts that the defendants intended it to be understood that they had erected the tramway. It is as distinct a representation to that effect as if it had been expressed in plain language . . . If it is proved to the satisfaction of the Court in a case of this kind that the defendants did in truth say that the plaintiffs' goods were theirs, I think that, as between rivals in trade, the Court would be justified in drawing the inference that the wide circulation of such a statement would necessarily damage the plaintiffs quite as much as in the ordinary case of the passing off of goods." These observations seem to show that if the plaintiffs had been able to show that they had themselves erected the cableway, they would have had judgment ; but the case was decided against them on another point. We may draw the following conclusion :—That if Jones sells or advertises boots and shoes manufactured by himself in such a way as to make the public believe they are Brown's, and so obtain the benefit of Brown's good name, he may be restrained by injunction.

In a Scotch case, Parozone Co., Ltd., *v.* Johnson Gibson (1904, 21 R.P.C. 317), the plaintiff company invented and applied the name "Parozone" to a bleaching fluid made by them, and it was admitted that they were entitled to the exclusive use of that name as indicating fluid manufactured by them only. Gibson, another trader, also made a bleaching fluid, but said that he never sold it as "Parozone," and when asked for that substance explained that his fluid was not "Parozone." The plaintiff company proved that on five occasions to two persons Gibson, or his servants, sold his fluid in answer to a request for "Parozone," and without explanation. They further proved that Gibson pointed out to two former shop girls the jar where he kept "Parozone," and that it was a matter of daily occurrence for Gibson's fluid to be sold to customers who asked for "Parozone" without explanation. Gibson proved that on some occasions he had explained that his bleach was not "Parozone." It was held on these facts that the plaintiff company were entitled to the injunction.

It is next necessary to deal with the provisions of the Merchandise Marks Acts, which prevent a trader from passing off his goods as those of another trader, and make him criminally liable. The first section of the Merchandise Marks Act, 1887, makes it an offence, among other things : (1) to forge a trade mark ; (2) to falsely apply to goods any trade mark or any mark so nearly resembling a trade mark as to be calculated to deceive ; (3) to apply any false trade description to goods ; and (4) to cause any of these things to be done. But it is not to be an offence if the person charged proves that he "acted without intent to defraud." Trade mark in this and the provision next referred to means a trade mark registered at the Patent Office, but it also includes certain foreign and Colonial trade marks, for which the Act itself must be consulted. Sec. 2 (2) makes it an offence to sell or expose for sale, or possess for the purposes of sale or any other trade purposes, any goods or things to which a false trade mark or a false trade description is applied, or to which any trade mark or any mark so nearly resembling a trade mark as to be calculated to deceive, is falsely applied. But it is not to be an offence if the person charged proves "(*a*) that, having taken all reasonable precautions against committing an offence against this Act, he had, at the time of the commission of the alleged offence, no reason to suspect the genuineness of the trade mark, mark or trade description ; and (*b*) that, on demand made by or on behalf of the prosecutor, he gave all the information in his power with respect to the persons from whom he obtained such goods or things ; or (*c*) that otherwise he had acted innocently."

Forging a trade mark is defined by the Act as follows :—"A person shall be deemed to forge a trade mark who either (*a*) without the assent of the proprietor of the trade mark makes that trade mark, or a mark so nearly resembling that trade mark, as to be calculated to deceive ; or (*b*) falsifies any genuine trade mark, whether by alteration, addition, effacement or otherwise ; and any trade mark or mark so made or falsified is in this Act referred to as a forged trade mark. Provided that in any prosecution for forging a trade mark, the burden of proving the assent of the proprietor shall lie on the defendant."

Applying a trade mark or mark or trade description to goods is defined by the Act : "(1) A person shall be deemed to apply a trade mark or mark or trade description to goods who (*a*) applies it to the goods themselves ; or (*b*) applies it to any covering, label, reel or other thing in or with which the goods are sold or exposed, or had in possession, for any purpose of sale, trade or manufacture ; or (*c*) places, encloses or annexes, any goods which are sold or exposed, or had in possession, for any purpose of sale, trade or manufacture, in, with, or to any covering, label, reel, or other thing to which a trade mark or trade description has been applied ; or (*d*) uses a trade mark or mark or trade description in any manner calculated to lead to the belief that the goods in connection with which it is used are designated or described by that trade mark, hall mark or trade description ; (2) the expression 'covering' includes any stopper, cask, bottle, vessel, box, cover, capsule, case, frame or wrapper, and the expression 'label' includes any band or ticket. A trade mark or mark or trade description shall be deemed to be applied whether it is woven, impressed, or otherwise worked into, or annexed, or affixed to the goods, or to any covering, label, reel, or other thing ; (3) a person shall be deemed to falsely apply to goods a trade mark or mark who without the assent of the proprietor of a trade mark applies such trade mark, or a mark so nearly resembling it as to be calculated to deceive : but in any prosecution for falsely applying a trade mark or mark to goods, the burden of proving the assent of the proprietor shall lie on the defendant."

A trade description is defined by Sec. 3 of the Act as any description, statement, or other indication direct, or indirect, as to certain things not material for the present purpose. A false trade description is defined by the same section as follows :—"The expression 'false trade description' means a trade description which is false in a material respect as regards the goods to which it is applied, and includes every alteration of a trade description, whether by way of addition, effacement, or otherwise, where that alteration makes the description false in a material respect ; and the fact that a trade description is a trade mark, or part of a trade mark, shall not prevent such trade description being a false trade description within the meaning of this Act. The expression 'goods' means anything which is the subject of trade manufacture or merchandise. The expressions 'person,' 'manufacturer, dealer or trader,' and 'proprietor,' include any body of persons corporate or incorporate. The expression 'name' includes any abbreviation of a name." The description must be false "in a material respect"—which means that it must be materially or substantially false, and not necessarily wholly false ; and it may be remarked that the section does not extend to mere verbal descriptions.

The first offence described consists in doing something illegal to goods ; the second consists in dealing with goods to which something illegal has been previously done. The first is aimed mainly at manufacturers, the second at sellers, wholesale or retail, not being themselves the manufacturers of the fraudulent goods.

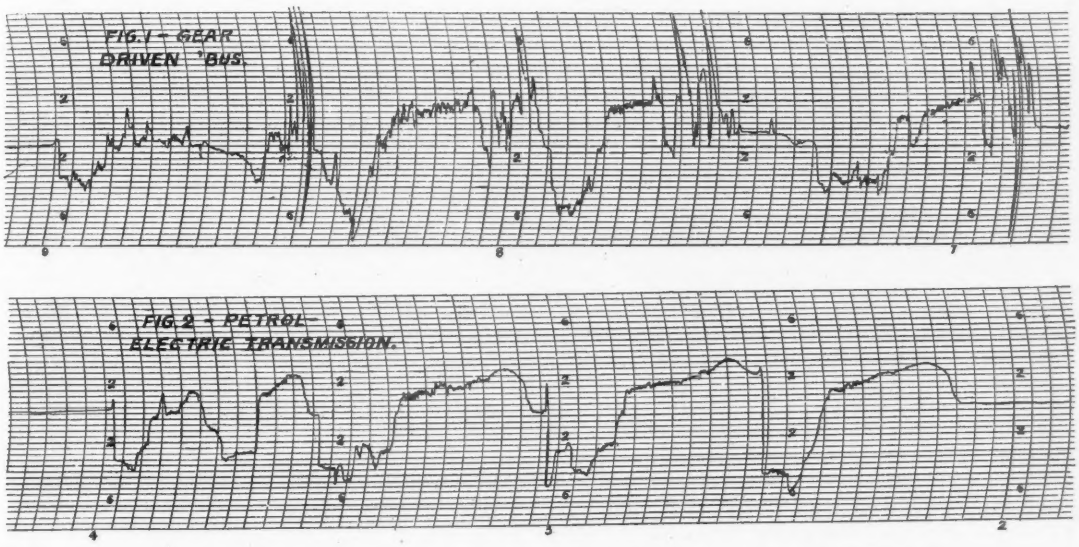
As to the first offence, it is not to be held to be committed when the person charged proves (the burden of proof is, of course, on him) that he "acted without intent to defraud." This does not mean intent to defraud any particular purchaser or other individual,

but intent to defraud generally by passing off an article as different to that which it really is. It does not cover what are mere cases of inaccuracy of description.

It remains to consider the effect of some recent cases relating to trade marks. It was held in Andrews *v.* Kuchurich, 29 T.L.R. 181, that Sec. 37 of the Trade Marks Act, 1905, only requires the *bona fide* user of the trade mark—namely, the registered mark, in connection with the goods for which it is registered; it does not in terms require the mark to be "used as a trade mark," and if the registered mark is *bona fide* impressed upon the goods there is a *bona fide* user of the mark in connection with the goods within the meaning of the section although the house mark or other matter is added.

A surname cannot, of course, be registered as a trade mark; and it has been decided that where the Board of Trade has determined that a particular name is not outside the category of registrable trade marks, and has directed the Registrar to proceed with the application for its registration and determine whether the name is a distinctive mark, the Court is precluded from afterwards saying that the name is outside the category of registrable trade marks. (In *re* Trade Mark No. 312,065, and in Trade Marks Act, 1905, 29 T.L.R. 117.)

The principle that a word description of an article cannot be registered as its trade mark is well illustrated by the case of *re* Colgate & Co.'s mark, 29 T.L.R. 326. There the word "Ribbon" was held not to be a registrable trade mark for a dentifrice, inasmuch as the word as used by the applicants was descriptive of the form and character of the dentifrice in respect that it described the manner and form in which the dentifrice came out of the tube in which it was sold.




Figs. 1 and 2.—Accelerometer Records of Gear-Driven Petrol-Electric 'Buses.

## PETROL-ELECTRIC 'BUSES: TRANSMISSION STRAINS AND OPERATING COSTS.

When any vehicle starts from rest, or, in general, changes from one speed to a higher speed, there is required in addition to energy overcoming transmission, road or rail and wind resistances, energy to accelerate the mass of the vehicle. The power required for the latter purpose varies directly with the rate of acceleration. Thus a force of 70 lb. per ton mass of the vehicle will impart to the whole an acceleration of 1 ft. per sec. per sec., while to impart an acceleration of 2 ft. per sec. per sec. requires the application of 140 lb. accelerating force per ton and so on. Obviously, the stresses to which the whole of the vehicle, and in particular the transmission gear, wheels and tires, are subjected will vary with the acceleration and—since a certain speed can be reached in a certain time by the application of a steady acceleration considerably less than the maximum value of the acceleration required if the latter be variable—it is obviously desirable that the acceleration, whether from rest, or from one speed to any other, should be as uniform as possible.

The Wimperis accelerometer has been adopted by the Royal Automobile Club as an instrument for indicating and recording the acceleration of a vehicle under test. A pen controlled by a freely pivoted weight forms a continuous record on a calibrated chart of the accelerations and decelerations to which the vehicle carrying the instrument is subjected. The force doing useful work at the point of contact between the road wheels and ground equals at any moment (acceleration (ft. per sec. $^2$) × wt. of vehicle (tons) × 70) lb. The greater the value of this product, the more severe the strain and wear on the tires and other parts.

The accompanying illustrations are reproduced from accelerometer records taken on a well-known gear-driven omnibus (fig. 1) and on a 40-H.P. Tilling-Stevens petrol-electric 'bus (fig. 2) on the same road and under identical conditions. The rapid and violent fluctuations in the former curve are attributable to the clutch and gear changes, and the advantages offered by the petrol-electric transmission in respect of smooth acceleration and hence minimum transmission strains and minimum discomfort to passengers, as shown in the second curve, are obvious. Though, in the tests during which these records were taken, the Tilling-Stevens vehicle was driven considerably faster than the gear-driven 'bus, the maximum acceleration in the former case was less than 3·5 ft. per sec. per sec. (corresponding to 245 lb. per ton on the road wheels), as compared with intermittent accelerations exceeding 8 ft. per sec. per sec. (maximum strains at rim of road wheels = 560 lb. per ton weight of vehicle), in the case of the gear-driven 'bus.

It is impossible for the driver to accelerate a "T.-S." petrol-electric vehicle at an excessive rate, but since the acceleration is constant, a given speed can be attained more rapidly than in other 'buses of the same rating. The transmission strains in a vehicle employing clutch and gear drive depend largely upon the skill of the driver; by no practical means can these shocks be limited and their magnitude in city service is excessive.

In addition to the great saving in upkeep of chassis and body effected by the "T.-S." petrol-electric system, the cost of tire renewals is much reduced by the elimination of sudden wide fluctuations in the force exerted at the wheel rim. In running over 3,000,000 miles on "Continental" tires in London, an average service of 20,148 miles per tire has been obtained. The total cost of operating a fleet of 150 "T.-S." petrol-electric 'buses in London, averaged during last year a fraction over 7d. per mile made up as follows:—Drivers, 1·251; tires, 1·098; petrol, 1·067; running, ·868; depreciation, rent, rates and taxes, ·849; conductors, ·847; traffic expenses, ·270; maintenance, ·240; body upkeep, ·235; trade vehicles, ·151; lubricating oil, ·078; lighting, ·069; paraffin, ·021; grease, ·018; clothing, ·001; total, 7·063d. per mile.

**The Shops Act.**—The report of the Leeds Shops Inspector (Mr. A. H. Rutherford) during the first year of the working of the Shops Act, 1912, has just been issued, and shows that during the 12 months ended March 31st last, 6,069 places of business had been visited, 23 persons had been summoned for offences against the Act, of whom 15 were penalised to the extent of £16 8s. 6d., and the remainder were dealt with under the Probationers' Act, and ordered to pay the costs. The Inspector stated that the greatest difficulties are presented in connection with mixed trades, for in some cases these traders have to exhibit five separate notices. He expressed the opinion that if the Inspectors were not constantly visiting shops and reminding traders of their liability under the Act in neglecting to exhibit one or other of these notices, the practice would gradually fall into desuetude. There were 11,000 persons in Leeds who came under the Shops Act, and during the year it was found that in 2,606 cases statutory notices were exhibited, whilst in 3,044 instances they were not exhibited, and warnings had been given. There were 826 traders exempt from the provisions of the Act. In connection with the weekly half-day holiday, 505 traders closed on Monday, 222 on Tuesday, 3,976 on Wednesday, 145 on Thursday, 54 on Friday, and 327 on Saturday.

## IMPERIAL WIRELESS SYSTEM.

On Friday last the new agreement with the Marconi Wireless Telegraph Co. was discussed in the House of Common at considerable length. Mr. Masterman moved that the agreement be approved, and pointed out that the matter was one of urgency; to allege that because nothing had happened through the delay already experienced, nothing would happen if that delay were continued, was as absurd an argument as to say that if a man neglected to insure his house against fire for a time, and suffered no loss, he need not insure it all. No existing Government department could or would carry out the work; the formation of a new department would involve delay and heavy expense, as well as the payment of royalty on patents; the Treasury was convinced that it was impossible to proceed by open tender, as only one company could show actual constant commercial working by day and night over the distances required for the Imperial chain. If reasonable terms could not have been obtained from that company, the Treasury would have fallen back on the attempt to construct the chain itself, but fortunately the Postmaster-General had been able to extort a very desirable concession with regard to splitting up the 10 per cent. royalty, and had secured a very substantial modification of the right of inspection by the company. The Treasury was satisfied that the best possible bargain had been made, and was sanctioning the contract for the erection of the first three stations, and later of the complete chain.

Sir Henry Norman opposed the resolution on the ground that, in his opinion, no harm would be done by a few months' delay. He thought the work should be done by the State; there would be compensation in efficiency for the delay, and the greater initial cost would be followed by subsequent saving in expenditure. Much of the work was ordinary contractors' work, and a good deal of the wireless apparatus could be supplied ready made. Any electrical wireless expert could do the ordinary everyday work of any system. He was unable to support the ratification of the improved contract, and appealed for further investigation and consideration of the question. Sir G. C. Marks pointed out that the previous contract was recommended to the House as an excellent bargain, and now they were told the same thing with regard to a contract which differed in many respects from the former; the attacks on the old contract had been justified by the new contract. One of his contentions had been that in some cases there might be no patents, and this was so in a place where the largest station would be erected; he asked where else patents did not exist. He could not understand why the agreement should last for 28 years. Many of the points objected to in the old contract had been omitted from the new one. An alternative price should be inserted for purchase outright in place of a royalty. The royalty should be in proportion to the value of the patent. It was for the House to tell the Admiralty officials to do its bidding, and he intended to vote for an amendment as a protest against a department endeavouring to over-ride an industry, and to prejudice the country.

Lord R. Cecil moved as an amendment, that in the absence of a report by any body independent of the Government, the House was not prepared to approve of the agreement. He said that the provision that the Government should not use any continuous-wave system in the three later stations without giving the Marconi Co. the opportunity to do the work, must tie the Government to the company, and assist the latter to establish a world-wide monopoly of wireless telegraphy. The bargain was little better than it was before—the new contract was better for the company than the old one. If the State had done the work itself, he believed the cost would have been less than under this contract. The Postmaster-General would probably have no difficulty in collecting an efficient staff in a few weeks, and a delay of six months was not a very serious risk. It was undesirable that a private company should know every detail of the system employed for military communication. He disliked the methods of management of the Marconi Co., and it appeared to him that the action of the managing director when he offered 100,000 shares in the American Co. to a member of the Government, was susceptible of a very sinister interpretation. In his judgment the decision, which was that of the Post Office alone, was a wrong one.

Mr. H. Terrell seconded the amendment, and complained of the inadequacy of the penalty for delay in the completion of the stations.

Mr. H. Samuel stated that the 1909 agreement with the Marconi Co. was strictly limited to the ship and shore stations, and expressly excluded communication with foreign countries or Colonial possessions. He pointed out that Sir Henry Norman's proposal that the wireless stations should be designed and erected by a committee was hopelessly impracticable, and there was no power to compel the Marconi Co. to supply wireless apparatus ready-made. Not only in England, but also in almost every country, the Government was employing contractors to carry out the erection of long-distance wireless stations, the sole exception being the Australian Government, which was now engaged in litigation with the Marconi Co. on the subject. It did not require a fleet to cut a cable, and the wireless stations were required for communicating not only with the fleet, but also with the outlying parts of the Empire if the cables were cut. Within the last day or two, the Army Council had declared the provision of the stations to be a matter of urgency; the Committee of Imperial Defence, the Select Committee, and the Admiralty had also expressed this view, and the Government could not ignore these repeated expressions of opinion on the part of the authorities responsible for the defence of the Empire. There were six patents of real importance, one of which would expire next year in the United Kingdom, and the last in 1925, and there were about 30 patents of minor value. The company asked for £250,000 for the unrestricted use in perpetuity of all its patents throughout the Empire, and would not reduce the price. Further patents were being taken up, and the contract gave the right to use all existing and future Marconi patents without additional payment. The contract represented the views of two parties, and naturally was very different from what he would have drawn up himself, but he believed it was better than any of the alternatives that were open. The company gave a guarantee of working, to which he attached the first importance, and took all risks. The company provided duplex working, a speed of automatic working higher than in the case of ordinary cables, and the benefit of its experience, which was of the greatest value, as well as Mr. Marconi's personal assistance. The royalty was based on gross receipts in order that the company might have no voice whatever in the management of the stations; if it were to be paid only on profits the company could not be excluded from determining how the stations were to be run and what rates should be charged. It was not anticipated that the royalty would reach anything like the colossal sums that had been suggested. Obviously the Government would not continue to pay a royalty for the use of a single unimportant patent. In voting for the contract the House would be voting for State ownership and complete liberty on the part of the Government to use any system it chose. He preferred to accept the judgment of the Parker Committee and his expert advisers rather than the *ex parte* statements of the advocates of rival systems. It was essential that the State should fit itself to secure the proper management and development of wireless telegraphy, and a small engineering committee consisting of Post Office engineers and possibly one or two from the Admiralty, presided over by Mr. Duddell, would watch the erection of the stations, order experiments to be made, and train the necessary staff. An establishment committee under the Secretary of the Post Office would deal with other matters. The Parker Committee would be maintained as a standing committee. A scheme was being evolved for carrying on scientific research on an adequate scale, which should be in working order before the next session. By that means they would have an efficient organisation under Government auspices which would render the State independent of commercial companies and enable it to develop the service on its own lines.

Mr. Bonar Law thought the arrangement was a bad bargain, and that the industry was changing so rapidly, that it was undesirable to lose the advantage of knowing what would be known in a month or two as to what could be done by other systems, merely because there was to be no autumn Session. He did not agree that there had been a rise in the price of materials, or that money had gone up in value. The Marconi company had not done on a commercial basis anything like what it had undertaken to do under the contract, and was, in fact, awaiting developments in order to enable it to fulfil the contract. He admitted the urgency, but asked what difference a delay of a few months would make. The Poulsen company had offered to give the service required for £40,000 a station, including all royalties, and had been commissioned by the United States Government to build the Panama station, transmitting over a distance 50 per cent. greater; surely it was worth waiting a month or two to see if they could do it, or to wait three months to save £120,000, apart from royalties. If the Postmaster-General had the right to commute the royalties, he would not object so strongly to the contract. He considered that the Postmaster-General did not know how to make a bargain. The company, he believed, was getting a profit on the erection of the stations, and was bound under the Patents Act to supply any patented article at a reasonable price to the Government. He had never known any arrangement by which royalty was paid on gross receipts; there should be some provision by which the royalty could be commuted. The matter ought not to be rushed through instead of giving it reasonable consideration.

Mr. Asquith laid stress on the important strategical considerations at stake, and would not admit that a delay of one or two months could be lightly regarded. He would have preferred that the work should be done by the Government; but that course would have involved enormous additional expenditure and prolonged delay. If the contract were rejected, the only alternative was for the Government to undertake the work. The Admiralty could not spare a man from its own work for any extraneous work, however important, nor could the War Office. There was a provision in the contract that if the price of materials fell, the sum to be paid should be reduced. The opinions of Lord Parker and Mr. Duddell in July proved conclusively that there was no other company that could possibly be safely entrusted with the contract. The work ought to be begun at the earliest possible moment. The Government had a free hand, and the country would get the benefit of all the developments of electrical science in the future.

The amendment was rejected by 221 to 140, and the agreement was approved by 210 to 138.

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**Litigation in United States.**—In view of the numerous electrical arrangements which have lately been introduced in the United States for the starting of the engines of petrol motor-cars, it is not surprising to learn of litigation in connection with alleged infringement of patents. The first action of the kind is that which is being brought by the Dayton Engineering Laboratory Co., of Dayton, O., the owners of the Delco starter patents, against the North-East Electric Co., of Rochester, N.Y.

## THE ELECTRICAL HEAT TREATMENT OF TOOL STEELS.

It is nowadays recognised that the value of tool steel depends very much upon the heat treatment to which it is subjected; and with the growing recognition of the necessity for exact temperature regulation, the value of the electric furnace is becoming increasingly apparent. Experience has proved that the quality and performance of the tool depends nearly as much upon its heat treatment as upon the quality of the steel from which the tool is made; and as it is the final process in the production of the tool, heat treatment is most vital. The effectiveness of such treatment depends upon having a furnace capable of being manipulated so as to produce as nearly as possible the desired heat and atmospheric conditions, and a typical furnace which has done very good work in this respect is the Hoskins muffle chamber furnace made by the Hoskins Manufacturing Co., of Detroit, U.S.A.

The heating element in this furnace consists of two piles of flat carbon plates or resisters, one pile being placed on each side of the furnace chamber. Across the top of the chamber is a set of heavy carbon plates connecting the two sets of resisters together. Referring to fig. 1, the carbon resister plates are shown at R, while T represents the carbon top plates. Below the resisters, and extending downward through the bottom of the furnace, are a pair of heavy graphite electrodes, one at each side of the furnace, as shown at E. Between each electrode and the lower resister is a heavier bottom plate of graphite, shown at B, this preventing excessive heating of the electrodes, and distributing the pressure of the electrodes upon the resisters. At the lower end of each electrode is a brass electrode clamp C, which can be raised or lowered by means of the screws and gears shown at S. The electrode clamps also serve as water jackets, in order to keep the electrodes cool while the furnace is working, and the clamps are arranged to be connected by means of a small rubber hose to a ¼-in. water pipe.

Good heat insulation is secured by 6 in. of special porous fire brick on all sides of the furnace chamber, as shown at F. The efficiency of this heat insulation is shown by the fact that when the furnace chamber is raised to a temperature of 2,200° F., the hand can be held comfortably against the furnace case, and hence there is very little loss by radiation. Between the piles and resister plates and the fire brick walls, and also at the bottom of the furnace chamber, is a layer of refractory cement, shown at A in the figure. This cement protects the fire brick from the intense heat of the furnace. Around the graphite electrodes, as a protection to them from the air, is a layer of sand. This sand is kept in position by a thin layer of loose asbestos at the points where the electrodes pass up through the furnace shell.

Although the furnace has a muffle chamber there is actually no muffle used in its construction, and as it is well known that muffles do not stand up successfully against the intense heat required for high speed steels, the advantage from the maintenance point of view is apparent.

An important feature of the furnace is the draught hole which passes through the top and rear of the furnace chamber to the top surface of the furnace as shown at D. A movable cover is provided in order that the draught hole may be closed if necessary.

In order to allow the use of a pyrometer for measuring the furnace temperature, a hole suitable to admit a pyrometer and protecting tube passes from the rear of the furnace chamber to the outside as shown at P. At the front of the furnace are two small hand wheels, and at the lower end of the hand wheel shafts is a pair of bevel wheels S for the purpose of raising or lowering the electrodes. The furnace case, which is built of ¼-in. boiler plate reinforced by angle irons at the corners, is supported at a height convenient for the operator upon angle iron legs. The door of the furnace is of fire brick held by a pressed steel case, and is carefully counterbalanced so that it can be moved up and down readily. This fire brick, of course, prevents loss of heat by radiation, and a small peephole provided with a swinging cover allows the operator to see the interior of the furnace. The furnace is operated on low voltage alternating current, a transformer being used to step down the regular voltage to 20 volts for a small furnace, and to 27·5 for a larger size. Current is passed from the transformer through flexible copper strips to the electrode clamps, and it will be seen that the $C^2R$ heat produced in the resisters gives a purely radiated heat, providing the muffle effect without the disadvantages of a muffle.

When the furnace is up to working temperature, the heat is so equally radiated that the temperature is practically the same in every part of the chamber, and this has a very considerable influence in preventing distortion in the tool which is being heated, in sharp contrast to the way in which the high air pressure of fuel-burning furnaces forces the flame against the surface of tools pitting them and overheating delicate edges and corners, unless the muffle with its usual disadvantages is used. The temperature is regulated very simply by means of the hand wheels. The upward movement of the electrodes compresses the carbon resisters, reduces the contact resistance given to the current, allows an increased current to flow, as shown on the ammeter provided, and results in a rise in furnace temperature: the reverse process is obvious.

The limit of temperature which the furnace will stand is that of the fire-brick walls, and the furnace can be operated at 2,500° F. as a practical limit. It can be brought from cold up to 2,200° F. in 1 hour 15 minutes. In the type of furnace having the chamber dimensions of 6½ in. wide × 5 in. high × 12 in. deep, the maximum power required is 15 KW., while under ordinary working conditions the consumption per 10-hour day is found to be about 72 KW.-hours. In the larger furnaces, 12 in. × 8 in. high × 8 in. deep, the heating power is 30 KW., and the average consumption per 10-hour day is 143 KW.-hours.

When the furnace has been brought up to heat, the temperature can be maintained with less than half the amount of current required for the initial heating, and if the furnace is being operated daily, the time and current required to bring it up to heat at the beginning of the day are materially reduced on account of the heat insulation of the furnace lining. It has been found that when the current has been cut off for periods of 12 to 15 hours, the chamber temperatures of such furnaces have been as high as 700° F. or 800° F. The atmospheric control is important, because the successful hardening of tool steels depends very largely upon the conditions of the atmosphere in which they are placed. In general, the chamber atmosphere of a furnace is either oxidising, reducing, or neutral in character. The oxidising atmosphere is responsible for excessive scale, and nearly every fuel-burning furnace, because of the air required for combustion, has an oxidising chamber atmosphere. High-speed steel can be hardened with best results in a neutral atmosphere, while carbon steels are found to be hardened most successfully in a reducing atmosphere. In the furnace described, if the door and draught hole are closed, the highly-heated carbon resisters naturally produce a reducing atmosphere within the chamber. By opening the draught-hole, and admitting a small amount of air at the door, the condition is changed to a neutral one. An oxidising atmosphere can be obtained if desired by admitting a larger amount of air.

The thick layers of carbon at each side of the chamber store up

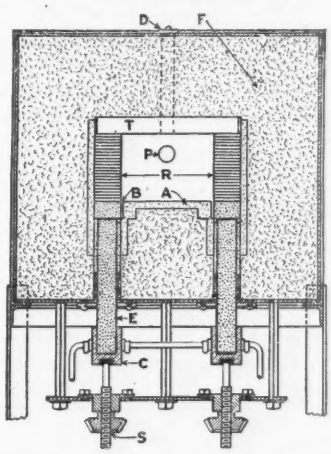


Fig. 1.—The Hoskins Electrical Muffle Furnace.

a good quantity of heat. When a piece of steel is placed in the furnace, this stored heat passes rapidly to the cooler steel and raises its temperature; therefore additional heat produced by the resisters can more quickly raise the steel to the necessary temperature. Rapid heating without danger of overheating is possible, because the chamber temperature can be constantly maintained at the point at which the steel has to be hardened. The tendency for the chamber temperature to drop when tools are placed in it can be immediately overcome by simply sending more current into the furnace and hastening the transfer of heat through the furnace to the tools. As the tools approach the chamber temperature the current can be gradually reduced.

Some rather interesting results have been obtained in the use of this furnace. For example, the maximum output of a bolt manufacturer's pressing dies was 150,000 bolts per set, the dies being made of high-speed steel carefully hardened in a fuel-burning furnace. Similar dies made of the same high-speed steel, correctly hardened in the electric furnace above described, made over 247,000 bolts, while a second set made 320,000 bolts, an increase of over 113 per cent. In another case 22 chasing dies and segmental taps and eight round rods made of three grades of high-speed steel, after being hardened in the electric furnace, showed an average change in size of only ·0011 in. per inch of length. Scleroscope readings taken after drawing the temper showed an average hardness of 79 at the threads on the taps and dies, and 86 for the round rods. All cutting teeth were sharp and clean; the surface of every piece was free from pitting, and there was practically no scale. A comparative test was made by a manufacturer of high-speed drills hardened by the best method previously known by him with exactly similar drills hardened in the electric furnace. Under the same working conditions the drills hardened by the original method, drilled an average of 31 holes against 95 holes by the one hardened in the electric furnace. Other instances could be given, but these are sufficiently impressive to show the increase of tool room efficiency which is gained by the use of electric heat treatment.

**Parliamentary.**—Various Bills.—In the House of Commons on August 8th the Lords' amendments to the L.C.C. (Tramways and Improvements) Bill and the Metropolitan Electric Tramways (Railless Traction) Bill were agreed to. The City and South London Railway Bill was ordered for third reading.

E

# LEGAL.

## Corfield *v.* Premier Electric and Hardware Co.

At the Westminster County Court on the 5th inst., before His Honour Judge Woodfall, this case was heard. Mr. Harold Brandon appeared on behalf of Mr. Corfield, the Receiver for the debenture-holders of the Davis Electrical Co., Ltd. The action was brought to recover £24 in respect of goods supplied and delivered to a Mr. Cohen, trading as the "Premier Electric and Hardware Co.," who counterclaimed for about £70. The goods supplied consisted of electrical cable, and the defendant alleged that by reason of the cable being defective, he had suffered damage, for which he was asking for compensation. Their answer to that, however, was that the cable was badly laid by incompetent workmen; that the work was done hurriedly and at a low price. The cable sold was "job cable," and it was described as such in the contract. In support of his case, he quoted Mr. Justice Darling's decision in the case of "Jarretts *v.* The Midland Tire Co.," that "job line, or job goods meant that the goods were supplied with all their faults." A gentleman of Mr. Cohen's experience must have known he was not getting the best English cable at the price he obtained that under review. The first order was a trial one of 17s. only. Afterwards the cable was tested at the Electrical Standardising Institute, and copies of the tests were sent to the defendant. The price then was £6 15s. per mile, which was subsequently reduced to £6 5s. per mile, and the plaintiffs also undertook then to take back any cable which was found defective. Eventually 6 miles of the job wire was supplied, and certain portions returned owing to local faults. On July 15th, 1912, 1 mile of the job cable was supplied; 2 miles on August 8th; 1 mile on August 17th; and on November 4th six more miles were supplied. When they received the last order, however, a letter was written by his clients stating they could not make themselves responsible any more for returns. That letter was not answered by the defendant, and on December 5th two more miles were ordered of the "job cable." On January 5th the defendant returned some coils of cable, and wrote saying that some of it was porous, and that he had had claims made by builders against him (the defendant) in respect of taking the cable out of the houses. As the average price of good English cable was £10 per mile, he asked His Honour to say that having bought "job cable" at £6 per mile, the defendant Cohen could not expect the very best goods without a single blemish. The price negatived any refusal of the contract.

Mr. Harry Emanuel Davis then gave evidence, stating he was now employed as manager and buyer to the Receiver for the debenture-holders of the Davis Electrical Co., Ltd. Previously, he was the managing director of the company. He remembered the cable being supplied to Mr. Cohen after tests had been carried out at the Electrical Standardising Institute. The reports showed that the wire had local faults. The price of the "job wire" was £6 5s., and the ordinary prices of the best English wire of the same size was about £11 per mile, so it was impossible for a trader to buy the best cable at a 100 per cent. discount. The words "job line" meant with all faults, or at the "buyer's risk."

Cross-examined: The Receiver was appointed in November, 1911, and he started supplying this particular wire in 1912.

Mr. Austin Farleigh (counsel for the defendant): What price did you pay for this cable?

Mr. Brandon: I object to that question. I think it sufficient to say it was a job line and sold as such. What it was originally bought for is a trade secret. Witness then wrote down the price he paid for it and handed it to his Honour.

Mr. Farleigh: Can you tell me whether this is English cable?—To the best of my belief I bought it from an English firm as English cable.

Do you object to giving the name of the firm from whom you bought it?—Yes, I do object.

His Honour: Why should you?—Because it would enable Mr. Cohen and other traders to go to that firm without going to us first. That is a trade secret, and I will hand up the name to your Honour.

Mr. Farleigh: Do you know whether this cable, in resistance, was lower than 600 megohms?—It might be a bit lower.

Continuing: He never knew that the defendant wanted the cable in connection with the lighting of some houses at Golder's Green. He did not know what the voltage was at that place, but a transformer could easily be installed to bring it down to the voltage required. The wire could be used for transmission of power. If, however, he was going to put the wire into houses, he would test it first. He further admitted that on July 24th, August 14th and 21st, goods were returned, and all those three returns were full coils of wire.

Re-examined: In all his firm bought 70 miles of this particular wire, and they sold it as "job line," and the only person who objected to it was the defendant. No complaints were made by other people.

Mr. Brandon said that concluded his case, except for the fact he had several witnesses to call in respect of the meaning of the words "job line."

His Honour said he thought it was an accepted phrase.

Evidence was then given by the defendant, Mr. Geo. Cohen, who said he had traded as the Premier Electric and Hardware Co., at 9-10, Cheapside, Golder's Green, N.W., but it was now a limited company. He had been in the trade for 17 years, and had contracts with some of the biggest builders in the district. His work was to wire the houses in carcass as they were being built. At the time he first bought this wire, Mr. Davis called upon him and said it was bankrupt stock and he could let it go cheaply, and also that he would take back any portion of it which turned out unsatisfactory. Mr. Davis knew what he wanted the wire for, and on one occasion he (witness) sent back as many as 31 coils out of 100. The defect were that the coils were broken, and rather than run any unnecessary risks he returned them. He subjected some of the wire to "dry" tests, and found that the resistance was very low, and that it would be dangerous to put it into houses, as it would be likely to cause fire. He received several complaints from the builders whom he supplied, and stood a chance of losing the contracts with them. When the plaintiffs wrote saying they would supply further wire on the understanding no more could be taken back in case of defects, he at once telephoned stating he would not take any more if that was so, and asked Mr. Davis to come and see him. That gentleman did soon afterwards call upon him, and eventually said he would continue to supply the wire and take back any that was defective. He (witness) only took cable from him on those conditions.

His Honour: Why, if you found the cable so defective, did you continue using it?—I was not anxious to use it. Mr. Davis was in my office over an hour before he could persuade me to take any more, and it was only upon him promising to take back any defective portions that I continued with him.

Cross-examined: He denied that the average price for the best cable of the same size was £11. He could buy it at the time, and even now, at £8 to £8 10s per mile. When he bought it from the plaintiffs he thought he was getting the best at £6 5s., because it was bankrupt stock. The price of cable varied very much, according to the fluctuations of the prices of rubber and copper, particularly the latter.

We told you it was a "job line"—Yes.

Did you tell the builders, for whom you wired houses, it was a ob line?—Certainly not. It was nothing to do with them. So long as the wire passed the tests, it was not for them to ask where I bought it. It made no difference to them, and they did not ask where I got it from.

At this stage the proceedings were adjourned until after the Long Vacation.

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## Electricity in Mines: Breach of Regulations.

According to reports in several newspapers, the Measham Collieries, Ltd., were summoned at the Ashby de la Zouch Police Court on 9th inst., for failing to comply with certain special rules for the installation and use of electricity in mines. It was stated that certain electrical apparatus was not earthed by connection to an earthing system at the surface of the mine or protected so as to prevent accidental contact by persons. There were 18 summonses. The company was fined £105 and £19 4s. costs. Similar charges were preferred against Mr. Thomas Watson, manager of the mine, whose defence was that he was hampered by not being allowed to order what was necessary to remedy the defects, which he had brought to the notice of the director, Mr. Maddell, who, on his part, denied this.

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## X.L. Electric Co., Ltd., *v.* Aron.

On the motion in this action to commit the defendant for breach of an order of June 20th, coming before Mr. Justice Astbury in the Vacation Court, Mr. Simmons, for the defendant, took the objection that certain exhibits to the affidavits had never been served upon him. The notice of motion, he said, asked for both committal and attachment, and under the rules the procedure in each case was different.

Mr. Hemmerde, K.C., who, with Mr. Moritz, appeared for the plaintiffs, said that he only intended to proceed for a committal, or, in the alternative—and that was what he really asked for—a four-day order on the defendant to sign certain documents. The order on the defendant, in respect of which a committal was asked for, was that he should not delay, or prevent, or permit to be delayed or prevented, an application for the granting of letters patent assigned to the company. To obtain the patents it was necessary that the defendant should sign a certain document required by the Comptroller, and this he refused to do. Without his sanction the application for the patent could not go on, and his refusal to sign the necessary documents, counsel submitted, was delaying or preventing within the terms of the order.

Mr. Simmons submitted that there was no order on his client to do anything, and the Judge, in making the order, had expressly said it was not mandatory.

After further discussion, Mr. Hemmerde said he was not pressing for a committal. What he was asking for was an order on the defendant to sign the necessary documents within a limited time.

His Lordship said the real question was whether the plaintiffs were entitled to a four-day order. Is the defendant willing to obey the order within a reasonable time? Does he want to obey the order, or does he not? Are you willing to obey the order within a time fixed? Mr. Simmons: Absolutely. His client could do it within four days.

His Lordship said he would have the matter definite. The defendant would undertake within four days to sign the specification exhibited, and subsequently any documents required by the the Comptroller, to give effect to that specification. On that there would be no order, except that the costs of the motion would be costs in the action.

ARON *v.* X.L. ELECTRIC CO., LTD.

MR. JUSTICE ASTBURY, sitting as vacation judge, on Wednesday, August 13th, had before him a motion by the plaintiff, Aron, asking that a writ of sequestration might issue, and that Mr. Clarence Wheeler, one of the directors, might stand committed to prison for an alleged contempt of Court.

MR. HEMMERDE, K.C., who represented the company, asked that the receiver appointed on behalf of the debenture-holders might be made a party to the proceedings.

MR. SIMMONS, for Mr. Aron, said he had to apply that the motion might stand over.

MR. HEMMERDE objected to any adjournment. The whole proceedings, he submitted, were totally vexatious. This was one of a number of vexations with which the company had been threatened. Mr. Aron had threatened to ruin this company, and this was one of his attempts to do so. Rather than have the matter go over, he would rely only on certain paragraphs of his affidavits.

After further hearing, MR. HEMMERDE asked that the motion might be dismissed, with costs.

MR. JUSTICE ASTBURY said he could not do that without giving the plaintiff an opportunity of filing evidence in reply.

The motion was directed to stand over for a week.

## BUSINESS NOTES.

**New Zealand.**—The New Zealand Customs authorities have lately given a decision to the effect that "vulcanite cleats for holding electric wires" are to be classified under No. 175 of the Tariff, the duty being 30 per cent. *ad valorem* on foreign goods, and 20 per cent. on British production.

**Exhibition.**—MESSRS. SELFRIDGE & CO., LTD., Oxford Street, London, W., opened a scientific exhibition in the Palm Court on Monday last, and it is to run until 23rd inst. The exhibits, as detailed in the catalogue, include telephone exchanges, arc lamps, wireless telegraphy and X-ray apparatus, magneto-electric printing telegraph station, "Synchronome" and "Eureka" electric clocks, tungsten lamp manufacture (B.T.H.), the Telewriter, electric incubator, cold light, &c., and there are also electric cooking and heating demonstrations.

**Bankruptcy Proceedings.**—FREDERICK THOMAS JOHNSON (described in the petition as Frederick Johnson), 60, Eltisley Avenue, Newnham, Cambridge, electrical engineer.—The receiving order herein was made on a creditor's petition, and, according to the accounts prepared, the liabilities amount to £307, and the assets are estimated to produce £104, leaving a deficiency of £202. It appears that the debtor previously failed in the Kingston Court in 1900, in the Wandsworth Court in 1903, in the Midlands a few years afterwards, and at Blackheath in the name of F. E. Elliot in 1912. He has not obtained his discharge in any of these proceedings, and did not in 1912 surrender to the proceedings. He attributed his present position to insufficient capital.

J. F. BARNES, Oldbury, electrical and mechanical engineer and picture house proprietor.—Receiving order made August 6th at West Bromwich Court on debtor's own petition. First meeting, August 20th, at Birmingham; public examination, September 19th, at West Bromwich.

W. LONGDON and V. G. COBB (Longdon & Cobb, electrical engineers, Nottingham).—First and final dividend, 1s. 4¾d. in the £, payable August 18th at 4, Castle Place, Park Street, Nottingham.

W. LONGDON (separate estate).—First and final dividend, 18s. 9d. in the £. See above.

**Dissolutions and Liquidations.**—TRACTION SUPPLIES CO., LTD.—A first and final dividend, 1s. 10½d. in the £, has been paid by the liquidator, Mr. T. Metcalf.

PERTH ELECTRIC TRAMWAYS, LTD.—A meeting of creditors will be held at 30 and 31, St. Swithin's Lane, E.C., on August 18th.

MITCHAM ELECTRIC FAN CO., LTD.—A meeting will be held at 6, Broad Street Place, E.C., on September 9th, to hear an account of the winding-up from the liquidator, Mr. A. Goodlet.

BRITISH FLEXIBLE SHAFT CO., engineers, Saltisford, Warwick.—Messrs. J. Sauer and Henry Waterhouse have dissolved partnership. The former will continue the business and attend to debts, &c.

BRITISH ELECTROMOBILE CO., LTD.—This company is winding up voluntarily, with Mr. R. B. Tyler, 1, Queen Victoria Street, E.C., as liquidator.

**Cryselco Holiday and Bonus.**—We understand that when the works of MESSRS. CRYSELCO, LTD., of Bedford, the manufacturers of the Cryselco carbon and metal filament lamps were closed on Saturday, August 2nd, for the August holiday week, the directors generously paid everybody employed wages for the week during which operations were suspended. In addition, a bonus of varying amounts was paid to all girls who had been employed by the company for three, five and eight years, and a special profit-sharing scheme was put in force, operating from June 1st, whereby each employé will receive a bonus each year, according to the profits of the company.

**Book Notices.**—The August *Journal* of the Tramways and Light Railways Association contains a report of the recent tramway rating case, Tottenham U.D.C. *v.* Metropolitan Electric Tramways, Ltd., and a list of members of the Association.

"Light, Radiation and Illumination." By Justus Eck, M.A. London: The Electrician Printing and Publishing Co., Ltd. Price 6s. net.

The recent lecture on "The Working Fluid of Internal-Combustion Engines," by Dr. Dugald Clerk, F.R.S., before the Junior Institution of Engineers, has been published by the Institution, and is obtainable from Messrs. Percival Marshall & Co., 66, Farringdon Street, London, E.C. Price 1s. 2d. post free.

"*Boletin* de la Sociedad de Fomento Fabril." Vol. XXX, No. 6. June 1st, 1913. Santiago, Chile: The Society.

"*Journal* of the United States Artillery." Vol. XL, No. 1. July-August, 1913. Fort Monroe, Va: The Coast Artillery School Press.

"*Journal* of the American Society of Mechanical Engineers." August, 1913. New York: The Society. Price 35 cents.

"*Boletin* de Ingenieros." Vol. III, No. 10. Mexico: Departmento de Ingenieros de la Secretaria de Guerra.

"*Bulletin* Mensuel of the Société Belge d'Electriciens." Vol. XXX, June, 1913. Brussels: E. Bruylant. Price 1 fr. 75.

"*Bulletin* Scientifique de l'Association des Elèves des Ecoles Spéciales." February, March and May, 1613. Liége: Lahaye & Co. Price 15 cents each.

"Herzogliche Technische Hochschule Carola-Wilhelmina zu Braunschweig." Programm fur das Studiejahr 1913-14. Brunswick: Vieweg & Sohn.

"Action of the Salts in Alkali Water and Sea Water on Cements." By P. H. Bates, A. J. Phillips and R. J. Wig. "The Evaporation Test for Mineral Lubricating and Transformer Oils." By C. E. Waters. "*Bulletin* of the Bureau of Standards." Vol. VIII, No. 4. Vol. IX, No. 1. March 1st and 15th, 1913. Washington: Government Printing Office.

"Science Abstracts." Vol. XVI, Part 7. July 28th, 1913. Sections A and B. London: E. and F. N. Spon, Ltd. Price 1s. 6d. net each.

"The Practical Metallography of Iron and Steel." By J. S. G. Primrose. Manchester: Scientific Publishing Co. Price 3s. net.

**Patent Restorations.**—An order has been made restoring patent No. 15,801 of 1901, for "Improvements in Holders for Electric Incandescent Lamps," granted to Harvey Hubbell.

Application has been made by Harry Wilkins for restoration of patent No. 14,733 of 1905 for "A new alloy."

**Trade Announcements.**—The Carlisle Electricity Department announces the following altered telephone numbers:—Offices, No. 67; works, No. 220.

MESSRS. WALLIS & WATSON, electrical engineers and contractors, have removed their offices and showrooms to 26, Park Row, Leeds. The showrooms contain a display of electric light fittings and heating and cooking apparatus, &c., and a department of automobile accessories has been added.

MESSRS. THERMIT, LTD., have removed into larger and more convenient works at 675, Commercial Road, London, E., to which all goods should in future be addressed. All communications should be sent to 27, Martin's Lane, Cannon Street, E.C., as before. New telephone number, "4292, City" (two lines).

**Catalogues and Lists.**—MESSRS. H. W. BUTLER AND CO., Craven House, Kingsway, London, W.C.—Forty-four-page illustrated catalogue of portable electric tools. Particulars are given in English, French and German of a range of electric drills for metals, also special drills for marble, and buffing, polishing and grinding machines. These machines are built with motors for D.C. up to 250 volts, and can also be supplied with motors suitable for single, two and three-phase A.C.

GESELLSCHAFT M.B.H. CLASSEN & CO., Barbarosstrasse 16, Berlin.—Price list of Fludor solder.

THE PULSOMETER ENGINEERING CO., LTD., Nine Elms Ironworks, Reading.—Twenty-four-page catalogue containing full details of the construction, performance, output, method of drive, &c., of their Pulsometer turbine centrifugal pump. Tabulated data respecting head due to friction of water, water discharged from pipes at different velocities, dimensions of pumps, belt pulleys, and flanges, shipping weights, also a private code and price list of fittings, are included.

THE WRIGHT ELECTRICAL SALES CO., LTD., 94, Albion Street, Leeds.—Illustrated leaflet describing the "Wescoscope" home electric cinematograph.

THE LONDON ELECTRIC WAREHOUSE CO., Manners Street, York Road, London, S.E.—Stock list, with prices, of D.C. motors, shunt wound, protected type, also a batch of other price lists of rubber-insulated cables, "Metallum" lamps, Benjamin reflector fittings, Primax interphones, Holophane glassware and fittings, and Brush arc lamps. Also a 90-page illustrated catalogue, with particulars and prices of a large variety of c.i. watertight fittings, cluster light fittings, street lighting lanterns and fittings, hand lamps, shop and ship fittings, bulkhead and deck fittings, and sundries belonging to the same class.

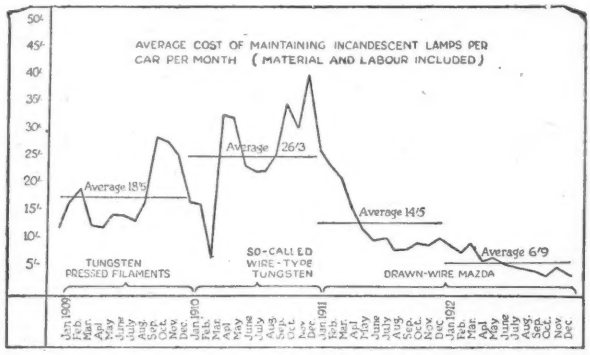
MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., Caxton House, London, S.W.—Illustrated price leaflet concerning their new type electric blower for hair-drying and other purposes.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., Tyssen Street, Dalston, N.E.—Pamphlet VL1, just issued, contains particulars and prices of the "Wotan" Verico lamp, giving daylight illumination, at a current consumption of 1·5 watts per C.P. It is intended for

drapers, storekeepers, colour printers, &c., who require an illumination in which colours can be matched as safely as with daylight.

The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., 100-106, Cannon Street, London, E.C.—List No. 11 (eight pages) containing tabulated prices of "Silvertown" Balata belting, from 3 to 10 ply and from 1 to 24 in. width.

**Mazda Lamps in Railway Service.**—The accompanying diagram translates the improved strength of the Mazda lamps into the pounds, shillings and pence of reduced maintenance costs. The curve was prepared by the Chicago Rock Island Railway of America, and shows the average maintenance costs per car per month for lamps, renewals and labour over a period of four years.


AVERAGE COST OF MAINTAINING INCANDESCENT LAMPS PER CAR PER MONTH (MATERIAL AND LABOUR INCLUDED)
50/-
45/-
40/-
35/-
30/-
25/-
20/-
15/-
10/-
5/-
Average 18/5
Average 26/3
Average 14/5
Average 6/9
TUNGSTEN PRESSED FILAMENTS
SO-CALLED WIRE-TYPE TUNGSTEN
DRAWN-WIRE MAZDA
Jan 1909 Feb. Mar. Apl May June July Aug. Sept. Oct. Nov. Dec. Jan 1910 Feb. Mar. Apl May June July Aug. Sept. Oct. Nov. Dec. Jan 1911 Feb. Mar. Apl May June July Aug. Sept. Oct. Nov. Dec. Jan 1912 Feb. Mar. Apl May June July Aug. Sept. Oct. Nov. Dec.

In the first year the ordinary "pressed" filament tungsten lamps were used, and the average monthly cost per car was 18s. 6d. In the second year so-called "wire" lamps were used, and the maintenance cost was 26s. 3d. Mazda drawn wire lamps were employed in the third and fourth years, and the average monthly maintenance cost per car was 14s. 5d. and 6s. 9d. respectively. The lower figure in 1912 was due to the improved strength of the Mazda lamps used in that year.

**The Anchor Hospital and Distress Fund.**—The third annual general meeting of members of this fund in operation at the Anchor Cable Works, Leigh, was held on Friday evening, August 1st. The objects of the Fund are:—(*a*) The granting of annual sums to hospitals and convalescent homes, &c., thereby ensuring to members hospital treatment in case of accident or other sickness, and (*b*) the granting of temporary relief to members in exceptional distressed circumstances, so that shop collections may be discontinued. The hon. secretary (Mr. A. Crooke) reported that every one of the employés at Leigh, including the staff, were members; each member paying 1d. per week. He pointed out the useful work which had been done by the Fund. Members have been sent to convalescent homes, and to sanatoria, in addition to recommendations having been issued to members requiring attention at various institutions. Moreover, members in exceptional distressed circumstances have been assisted in many ways. During the year an ambulance corps has been formed at the works, and its usefulness proved by the promptitude with which the members attended a serious accident at McGregor Bros.' works. There was a balance in hand of £81, out of which £49 was voted by way of grants to a number of hospitals, infirmaries, &c. The following officers were reappointed:—President, Mr. James O. Callender; trustees, Mr. J. Bowyer and Mr. C. Hulme; hon. secretary and treasurer, Mr. A. Crooke; hon. auditors, Messrs. W. Mort and W. Webster; together with a Committee of 10 others.

**Copper.**—The course of copper prices has fully borne out the hints conveyed in these columns during recent weeks, and even although the price has appreciated very considerably, it would be rash to assume that the top points have yet been seen. The exercise of caution is, however, a conspicuous virtue, when there has been so considerable an advance. The long expected American statistics when they did make their appearance showed an increase in the American stocks of refined material of 308 tons, at 23,926 tons, compared with 23,618 tons at the end of June. Market anticipations varied a good deal as to the result which would be shown, but the result must be considered as quite satisfactory when the production is considered. This was over 7,200 tons up on the month at 61,640 tons against 54,402 tons in June, the increase arising from the renewal of operations at the Nichols smelter, which had been partially stopped in June owing to a strike there. The serious disturbances in the Lake Superior region have not been reflected in the July returns, but they were not expected to be. It is the impression that the August figures will show the interference with the operations in this area, and if this proves to be the case, the next returns may be pretty well as good as those of June, though, at the same time, it must not be forgotten that the world's reserve stocks are too small for any very great reduction to be possible from the present level. There has been an enormous volume of business done within the past couple of weeks both in America and Europe, and even yet the demand persists, while it is doubtful whether consumers have at all anticipated needs. Most of them, indeed, seem to have been merely buying for the satisfaction of their needs in connection with work on hand, and there are no stocks in second hands or in the yards of users. The wave of optimism fairly caught consumers napping, but the situation was quickly recognised, and at once prices were advanced, and a very sustained upward movement has been witnessed. It is probable that consumers got very little copper at or near the bottom prices asked, for during June there was but little inquiry, everyone being obsessed with the idea that prices were going to collapse, hence there were crowded into the July buying movement orders which under normal conditions would have been spread over a period of two or three months. In the United States the wire mills have been actively replenishing their depleted stocks, and there has been considerable business booked for September and October, with some inquiry for November, though for the last-named month no important tonnage of metal was booked. Demands were particularly heavy for wire bars, the electrical people reporting a big demand for wire, and the mills are running at full pressure.

**Lead.**—Mail advices from Mexico recently received in London give some details regarding the interruption of operations at the smelting plants and mines there, from which it would appear that the position has not been at all exaggerated in its gravity. It is asserted that every smelting plant without exception in the Northern States is closed, those at Mapimi, Torreon, Asarco, Aguascalientes, San Luis Potosi, Monterey, and Matahuela, having been out of commission for periods ranging from 60 to 120 days, and it is added that the early resumption of operations is unlikely. It is impossible to get particulars of the state of affairs in the Southern districts of Chihuahua, and in the States of Durango, Sinaloa, Coahuila, Zacatecas, and Aguascilientes, owing to the cutting of railway and telegraphic communication. It is believed, however, that very few mines are operating. This applies alike to the lead and to the copper properties. The lead market is accordingly feeling the effects of the continued restriction of supplies from the country responsible under normal conditions for a matter of 10 per cent. of the world's output. There are occasions when the market wears an easy appearance, because somebody wants to sell a little near stuff, and dealers try to get it cheap, but the fundamental circumstances remain quite undisturbed, and it is useless to anticipate any material alteration until the general position in Mexico is vastly different from what it is to-day. Even under the most favourable conditions it would take months for conditions to assume their pre-revolution appearance. The stoppage of railway communication is a most serious matter. The North-Western Railway is practically at a standstill, and is passing its dividend on the preferred shares, the National Railway has sustained enormous losses, while the Southern Pacific are only operating 150 miles out of their 1,000 miles of track. This means that even when the actual fighting and brigandage are suppressed, time will be required before industrial operations can be resumed, because the mines cannot work without supplies, and these are all exhausted, and fresh material will have to be hauled from the coast. Altogether, therefore, the outlook is the reverse of rosy. Trade demands for lead continue on a moderate scale, the best support coming from the cable people and electrical industry generally, which, taken altogether, seems to have lately been taking a few fair contracts. At all events, these interests have bought more freely of both copper and lead, and, as is well known, the more important firms only buy their raw material against actual bookings of finished goods.

## LIGHTING and POWER NOTES.

**Australia.** — According to the *Australian Mining Standard*, the N.S.W. Railway Commissioners have decided to illuminate the whole of the stations from Sydney to Parramatta by electricity. The section from Sydney to Strathfield will be supplied from the Pyrmont power house, and a new generating station will be erected at Clyde to supply the remainder of the stations.

**Argentina.**—The Rosario City Council has rejected all the tenders received for the public lighting of the city and the *Review of the River Plate* suggests that the object is to secure the establishment of a second electric supply company in the city, although it considers it doubtful whether any serious concern would have anything to do with the Corporation after what has taken place.

**Algeria.**—The municipal authorities of Zemmora (Oran) have decided on the establishment of a central station in the town for electric lighting and power purposes.

**Batley.**—The T.C. has decided that from October 1st next the prices for electric supply shall be advanced, particularly for shop lighting, and has also resolved to apply to the L.G.B. for powers to borrow £8,206 for expenditure on mains, arc lighting, meters and services, and £1,550 for a proposed new feeder, distributors and services.

**Boston.**—Prov. Order.—The T.C. has been notified of the intention of Messrs. Crompton & Co., Ltd., to apply in the next session of Parliament to the B. of T. for a provisional order for electricity supply in the borough.

**Bury.**—Proposed Heywood Supply.—The Corporation has decided to enter into a provisional agreement with the Heywood Corporation for the supply of electricity in bulk, and application is to be made to the Lancashire Electric Power Co. for its consent to the proposed supply. Failing such consent, application is to be made to the B. of T. for an order dispensing with the consent of the Power Co. According to a Heywood newspaper, it is understood that the Bury Corporation will supply the current in bulk at cost price, and that the agreement will be for a term of 10 years, with an option of continuing for a further period of five years.

Generating Plant Extension.—The T.C. has decided on August 7th to make application to the L.G.B. for borrowing powers for £55,000 for electricity purposes. The amount required is divided up as follows:—Excess expenditure on buildings, £1,656; two rotary converters, £2,100; acquisition of land, £2,088; third turbine plant, Chamber Hall power station, £13,500; extension of Chamber Hall power station, £14,000; extension of E.H.T. mains, £10,000; additional transformers, £4,000; extension of L.T. mains, £5,000; and contingencies, 5 per cent., £2,656.

**Crewe.**—Having made inquiries respecting the provision of a coal bunker and coal-handling plant, the electrical engineer, Mr. Denton, has reported that the capital expenditure would be heavy, and the Electric Lighting Committee has approved his suggestion that it would be well to defer the question for the present.

The returns for the quarter show that 101,840 units have been sold to private consumers, and 48,062 units have been supplied for public lighting, increases of 20,559 units and 6,085 units respectively over the figures for the same period last year.

**Cromer.**—Regarding the recent B. of T. inquiry as to the proposed transfer of the electric light undertaking to Messrs. Edmundsons, the B. of T. has intimated to the U.D.C. that, "in the event of the transfer being allowed," it will be necessary for the Board to obtain the assistance of counsel in settling the draft deed, entailing extra cost. This is viewed as being in favour of the transfer.

**Doncaster.**—A new water-tube boiler is to be installed at the electricity works. This, together with the necessary foundations and steam pipes, is estimated to cost £1,800. Application is to be made to the L.G.B. to borrow this sum.

**Farnworth.** — Under the auspices of the electricity department, and by the arrangement with Messrs. Gillespie and Beales, a series of lectures and demonstrations on electric cooking have recently been given in the Moor Hall, by Mr. F. S. Grogan, of the British Electric Transformer Co.

**Felixstowe.**—L.G.B. Inquiry.—An inquiry was held on August 6th relative to the application of the U.D.C. for a loan of £4,729 for plant extensions at the Electricity Works, it being proposed to add another 150 kw. Diesel set, and a balancing set with switchgear. After some discussion the application was amended as follows, with an application for a total loan of £2,800:—Diesel engine set, £3,396, less £800 outstanding debt on the existing gas engines, and £340 on the existing Diesel generator; £110 for cables and foundations; £174 for engineers' fees and contingencies, and the balance for buildings, &c.

**Fife.**—In regard to the breakdown which recently occurred at the Fife Power Co.'s station, we understand that on Monday, 4th inst., owing to a breakdown of one of the large turbines, it was found necessary to curtail the tramway service, the other supply being fully maintained. On Thursday morning a reciprocating engine broke down which necessitated cutting off the supply to a few consumers including two collieries; the engine was repaired, and the supply restored by mid-day. It was also expected to have the full tramway service running on Wednesday last.

**Fordwich (Kent).**—The P.C. having decided to offer no objection to an electric light scheme proposed for the district, the Bridge R.D.C. has informed the promoters that it will offer no opposition.

**Hereford.**—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for a loan of £1,000 for services, and for £334 expended for mechanical stokers at the electricity works.

**India.**—A dispatch from Simla states that Elysium Hill and other poin's there are now lighted by electricity. The demand for wiring is so great that it looks as if the plant would have to be extended in the near future, especially as power may be needed to light Jutogh, Mashobra and Mahasu. The municipal authorities do not expect the scheme to pay for at least three years. Some of the Indian newspapers wax sarcastic over the fact that whilst Simla and other places are lighted by electricity, Bombay streets are still innocent of it. The Fort, Bombay, is electrically lighted, but the main streets are in a state of Cimmerian darkness.

**Japan.**—The plant of the Nippon Electric Light Co., in Tokio, has now been completed and passed by the Government inspectors. The Asakusa ward of the city is the first to be supplied with current.

**Kingstown.**—The Parliamentary wrangle in regard to the proposed Kingstown electric lighting scheme, which latter was opposed by the Irish Party, has resulted in the Kingstown order being suspended until next session. This procedure will avoid further expenditure on promotion of the scheme next year.

**Lytham.**—Supply from St. Anne's.—The Council having approached the St. Anne's U.D.C. with a view to obtaining a supply of electricity in bulk, the latter has indicated its willingness to give a supply, provided satisfactory arrangements can be made as to terms.

**Macclesfield.**—The T.C. was informed on August 6th that the B. of T. had consented to the erection of a generating station in Pickford Street, by the New Electricty Co., of Macclesfield.

**Middleton (Lancs.).**—At a meeting of the T.C. on August 6th, Councillor Grundy inquired if it was true that a local firm had applied to the Electricity Committee for a supply to the extent of 600 H.P., that the Committee could not supply it, and that the firm was going to be supplied from a source outside the borough. Councillor Wiggins replied that it was true that a firm had applied for power, and that the Committee could not supply it. They could only give the supply by a capital expenditure of at least £40,000, and therefore they were allowing the Lancashire Electric Power Co. to serve this particular firm under a particular agreement, which did not give the company any other rights.

**Oulton Broad.**—Street Lighting.—The U.D.C. has accepted the tender of the Oulton Broad Electricity Co., Ltd., for public lighting for one year at £2 3s. 6d. per lamp. The tender for gas lighting was £2 6s. 6d.

The Council on August 5th received from the Electricity Co. an intimation that it intended applying to the B. of T. for a prov. order for electric supply throughout the district.

**Ramsbottom.**—Street Lighting.—The Lighting Committee of the Council has recommended that further consideration be given to the offer of the Lancashire Electric Power Co. and the Ramsbottom Gas Co. for the lighting of the railless traction route, and a sub-committee has been appointed to inspect lighting arrangements in other districts.

Having considered an amended quotation from the Lancashire Electric Power Co. for street lighting by electricity at Summerseat, a deputation has been appointed to wait on Mr. Taite (of the company) with regard to the proposals.

**Reading.**—Street Lighting.—The T.C. has decided to compare public lighting by electricity and inverted incandescent gas burners, and has given notice to terminate the present contracts on March 31st next, when a decision will be arrived at.

**Rochdale.**—The Littleborough and Whitworth Councils have asked the Rochdale Corporation to continue to supply them with electricity in bulk, and it has been agreed to do so.

Three of the largest firms in Rochdale have come to terms with the Corporation for a supply of electricity.

The L.G.B. has sanctioned the borrowing by the Corporation of sums of £5,600 and £24,400 for extensions in connection with the electricity undertaking.

**Sheffield.**—The Electric Supply Sub-Committee has further considered the question of the future working of the Installation and Motor Department, lately known as the Wiring and Fittings Department, and recommends:—(1) That a showroom be maintained for the exhibition of electrical fittings, including such electric lighting fittings as the Corporation can only sell through a contractor carrying on the business independently of the Corporation. (2) That the following be the method of selling such electric light fittings:—(*a*) A list of such electrical contractors as are willing to agree with the Corporation to sell electric light fittings on agreed terms, be prepared and maintained; (*b*) that the Corporation canvassers and showroom attendants be supplied with this list, and authorised to inform customers that the Corporation will sell to them, through any of such electrical contractors, such electric light fittings as they may require, and to request the customer to arrange accordingly; (*c*) that all such electrical contractors and their customers be allowed access to the Corporation's showroom for the purpose of inspecting and selecting electric light fittings, and arranging between themselves for the sale and purchase thereof. (3) That an invitation be given to all electrical contractors in the city to place their names upon the list of contractors.

An application has been received from a firm with works at Beeley Wood, for a supply of energy. As the Yorkshire Electric Power Co. (within whose area of supply the premises are situated) has consented to the Corporation supplying the firm with electricity, application is to be made to the B. of T. for an order authorising the supply.

**Stockton-on-Tees.**—Power Co.'s Supply.—The T.C. has accepted the offer of the Cleveland and Durham Electric Power Co. for a further supply of current within the borough, subject to a formal agreement being entered into.

**St. Helens.**—Loan Sanction.—The T.C. has received from the L.G.B. sanction to a loan of £1,560, being the excess expenditure on a loan of £10,800 sanctioned in August, 1911, for electricity purposes, and to a further loan of £2,000 for converting plant.

**Swanage.**—The B. of T. has granted the application of the new electric light company for permission to erect a generating station on a site at Courthill. It will be remembered, as stated at the time in the Electrical Review, that there was opposition to the project, on the ground that the station would prove a nuisance to the neighbourhood, an allegation that was refuted by the promoters of the scheme, and unsupported by the B. of T. inspector, who held a local inquiry.

**Walsall.**—An inquiry has been held as to the terms upon which the Corporation would extend its mains and give a supply of energy to the premises of the Joint Committee of the Walsall and West Bromwich Unions, Great Barr Estate, but having regard to the heavy cost which would be entailed, the proposal could not be entertained.

**South Shields.**—At a meeting of the T.C. on the 6th inst., Alderman Rennoldson, in moving the adoption of the Electricity Committee's report, details of which have already been published, said that despite the fact that their coal had cost them £1,500 more than in the previous year, they had made a profit of £3,163. Another feature was that they had overtaken the drop which had occurred in the private lighting for five years. In 1908 they reached their maximum with a revenue of £14,360. During the next few years it decreased until it reached £12,400, but it had risen until last year it was £7 more than it ever had been, so that they had wiped out the loss occasioned through the introduction of the metal-filament lamp. The Committee recommended that the salary of the electrical engineer (Mr. H. S. Ellis) be increased from £400 to £500, but after some discussion it was advanced from £400 to £450. Alderman Wylie, in bringing forward the report of the Tramways Committee, said it had been shown clearly that they must have more cars. The report was adopted.

**Wallsend-on-Tyne.**—At a meeting of the T.C. on the 5th inst., the Sanitary Committee reported upon correspondence that had taken place between the Council and the Newcastle-on-Tyne Electric Supply Co. in regard to an alleged nuisance caused by the escape of grit from the chimney of the Carville power station. The Committee recommended that the town clerk should be instructed to obtain the assent of the Attorney-General to take the necessary legal steps to have it abated immediately.

**Wimbledon.**—Annual Accounts.—There was a net profit of £2,097 on the working of the electricity undertaking during the year ended March 31st last. The total expenditure during the 12 months amounted to £16,702 or 1·38d. per unit sold, as against 1·261d. in the preceding year. Against this expenditure was an income of £34,718 of which, after writing off bad debts and allowances, £34,240 was derived from the sale of current. Public lighting accounted for £5,568; the gross profit for the year was £18,015. Adding to the net profit the balance brought forward from last year there remains £7,474 to the credit of the suspense account, and of this, a balance of £6,791 is carried forward to next year's account. The total number of units sold during the year under review amounted to 2,903,831 from which an average price of 2·826d. was obtained. Of this total 1,463,330 went to private consumers for lighting purposes at an average price of 4·099d. per unit; 918,691 to private consumers for heating at an average price of ·961d. and 521,810 for public lighting from which the average price obtained was 2·561d.

## TRAMWAY and RAILWAY NOTES.

**Aberdeen.**—Year's Working.—The revenue of the Corporation tramways for the year ending May 31st was £80,166, an increase of £2,985 over the previous year. The working expenses were £43,206, an increase of £2,236, which is due to rising wages, extra cost of materials, and also to the 95,000 additional miles run during the year. The increase in the profit over the previous year was £1,366. Last year the department started a reserve account by a contribution of £4,396, and this year the whole of the profits will go the reserve fund. Parliamentary powers are to be asked to utilise one-third of these profits either for the relief of rates or a contribution to the common good. The Council has agreed to extend the length of the ½d. fare sections.

**Australia.**—According to *Tenders*, the Townsville Electric Tramway Co., Ltd., has been formed with a nominal capital of £60,000, in 120,000 shares of 10s. each; 80,000 shares were last month offered to the public. The object of the company is to construct electric tramways in Townsville (Q.) and suburbs.

**Ashton.**—As a result of an application for increased wages and extended holidays of the 400 employés of the Ashton Corporation Tramways, the Stalybridge, Hyde, Mossley and Dukinfield Joint Tramways Board, and the Oldham, Ashton and Hyde Tramways Co., a conference has been held of the three tramway authorities and employés' representatives, an offer being made to the employés which is to be submitted to the men. The men had refused arbitration and voted almost unanimously in favour of withdrawing their labour.

**Ayr.**—Year's Working.—The financial statement for the Ayr Tramways for the year ended May 15th last shows that the total income for the tramways from all sources amounted to the record sum of £16,295, an increase of £533 compared with the previous year. After providing for the sinking and the reserve funds, interest and repayment of loans, and placing £2,040 to depreciation and renewal fund, there remained a balance of £1,337, which is transferred to the burgh general assessment.

The newly-completed extension of the Corporation electric tramways to the racecourse was inspected last week by Colonel Druitt, who expressed himself satisfied with the new line. The new portion extends to 1,500 yards.

**Birkenhead.**—The Tramways Committee has under consideration the question of utilising motor-'buses to provide cross-town facilities and link up the various routes in the borough.

**Bacup.**—The town clerk has reported that the Rawtenstall Corporation has refused to accept the construction of the draft lease with respect to the schedule of fares, and that the two Corporations were submitting their respective contentions to Mr. C. C. Hutchinson, K.C., for decision.

**Blackburn.**—The quarterly report of Corporation tramways shows the revenue for the three months to be £18,991 against £17,854 last year. The traffic receipts were up on all sections. A total of 3,389,776 passengers were carried and the mileage run came to 302,296. There is a balance profit of £1,921, or exactly £200 more than the profit shown for the corresponding period last year.

**Crewe.**—Motor-'Buses.—Application is to be made to Parliament for powers to provide and run motor-'buses within the borough and also between the neighbouring towns of Nantwich, Sandbach, Willaston and Haslington.

**Dartford.**—The U.D.C. has decided to offer no objection to the application of the lessees of the tramways for the extension of time until August 18th, 1915, for the completion of the extension of the tramways to the Gravesend system. It has, however, reminded Messrs. Balfour, Beatty & Co. of their promise to construct and work the extension immediately they obtain the powers to do so.

**Doncaster.**—Proposed Loans.—The T.C. has decided to purchase at an estimated cost of £5,000 six additional tramcars similar to those now in use, and to extend the tramcar shed in Grey Friars Road at an estimated cost of £750. Application is to be made to the L.G.B. for the necessary borrowing powers.

A proposal to obtain six or eight motor-'buses as an experiment to run between Doncaster and Bradsworth, and Adwick-le-Street and Balby-with-Hexthorpe has been referred to the Council in committee.

**Dundee.**—Annual Report.—During the year ended May 15th the receipts on the Corporation cars amounted to £65,004, and the working expenses, including the maintenance of lines, to £39,421, leaving a balance of revenue over working expenses of £25,623. This sum has been apportioned in meeting interest, sinking fund, and depreciation; £7,400 has been allocated to the fund for renewals; a contribution of £1,500 has been made to the common good, leaving a surplus of £9 to be carried to reserve. The receipts exceeded the estimates by £4,464. The number of passengers carried was 17,734,162 while the cars covered 1,359,821 miles. The gross capital expenditure on the undertaking from the beginning has been £352,663 and the amount that has been applied in the reduction of debt up to the end of the year is £83,412. For the current year it is estimated that the revenue and expenditure will balance at £64,900. About £750 more is allowed for traffic expenses, the increase being largely due to a bigger wages bill.

**Glasgow.**—There has been under the consideration of the Tramways Committee, Sec. 49 of the Glasgow Corporation (Tramways Consolidation) Order, 1905, under which the Corporation is empowered to provide and run a service of omnibuses in prolongation of existing tramway routes, or for testing the amount of traffic along any route, subject to the consent of the local authority. The Committee was of opinion that it was desirable that the Corporation should make application to Parliament for powers to provide and run omnibuses in the city, and generally in the districts adjoining the city, and decided that such powers be asked for in the first provisional order.

At the above meeting the general manager (Mr. Dalrymple) reported upon the frequent and serious interruptions to tramway traffic by obstructions on the track caused by vehicles out of repair or overloaded breaking down, and the Committee agreed to recommend that powers be sought under the next provisional order to deal with this matter.

The T.C. proposes promoting a provisional order at the end of the year for the extension of several of the powers conferred upon it by previous legislation. In the new Bill the tramways department figures conspicuously. All the proposed extensions of the present system—reported some time ago in the Review—being included, with one exception, namely, a short line from Garngad to Provanmill. An important arrangement has been come to, subject to the T.C.'s approval, between the Tramways Committee and the representatives of the Airdrie and Coatbridge Tramways Committee. The meeting took place in connection with the extension of the Glasgow system from Bailliestow to Coatbridge, and the company has now agreed to grant the T.C. running powers over the portion of its lines from Langloan to Coatbridge, a distance of about a mile, on conditions somewhat similar to those made between the T.C. and the Paisley District Tramways Co. for the running of the Glasgow cars over the portion of that company's lines from Hawkhead to Paisley Cross.

**Halifax.**—Year's Working.—Some interesting figures are contained in the annual report of the working of the Halifax tramways department during the year ended March 31st last. Deducting the mortgage debt on the undertaking (£299,480) from the amount expended on capital account during the 12 months, there was left a net profit of £12,680, as compared with £18,020 in 1912, and £11,514 in 1911. The revenue totalled to £105,973, as against £101,893 in 1912, and the working expenses were £69,661 as against £62,890 a year ago. The tramways comprised nearly 55 miles of single track, and the number of passengers

carried on the tramways during the year was 19,456,923. Transfer tickets showed an increase of £316 on last year, and the cost of allowing blind persons to travel on the cars free of charge represented a sum of £37. It was stated in the report that the track all over the system was in a very bad state, and this was one of the primary causes of an increase in the number of broken axles and truck side frames.

**Leeds.**—Some feeling has been aroused amongst tramwaymen by the dismissal of a conductor named O'Leary for quarrelling with the driver of his car and using abusive language. O'Leary states that the reason of his dismissal was that he went to a public house, after informing an inspector of his intention, to convert a quantity of copper into silver and gold, this being against the regulations. The general manager (Mr. J. B. Hamilton), however, states that that was not the cause of O'Leary having to leave the service, for he was only cautioned for this offence, and the real reason for his dismissal was for quarrelling and using abusive language to the driver of his car. The men do not appear to wish for the reinstatement of O'Leary, but rather that similar punishment should be meted out to the driver concerned in the quarrel.

**London.**—Supply to Proposed P.O. Tube Line.—In connection with the examination of the Post Office tube scheme by the House of Lords' Committee, the question of the supply of electricity to this line, and the five district post offices on the route, was considered. Evidence was given by Mr. Slingo, P.O. Engineer-in-Chief, and his assistant, Mr. Gunton, to the effect that the department's own supply of energy cost it 1·077d. per unit for generation and delivery; the cost of generation, all charges included, of the Blackfriars and Mount Pleasant generating stations was given as ·627d. per unit. The cost of energy supplied by public suppliers was stated to average 2·16d. per unit, comparable with the 1·077d. mentioned above. Great importance was attached to the Postmaster-General having control of the supply—which, for the railway, is estimated at 490,000 units per annum. Evidence was given on behalf of the companies, who opposed the Post Office supplying its own requirements, it being stated that the London Electric Supply Corporation was supplying the Brighton Railway Co.'s line under a 17 years' agreement, with energy on a graduated scale, ranging from ¾d. to ½d. per unit. On behalf of the City of London and the Charing Cross companies, it was stated that they would be prepared to supply at ½d. per unit. The Committee, which approved of the construction of the line, decided that the Post Office should not itself supply the electrical energy required for its working. Subsequently, on behalf of the Government, a new sub-section was proposed, and after amendment accepted, which provides that the Postmaster-General should invite tenders for the supply of power to the railway, and if an appreciable saving would result, should purchase power from an outside source.

The Bill was read a third time and passed.

Proposed Crystal Palace Railway.—A scheme is being proposed, which we gather is to result in a Bill, to be presented in Parliamentary Session of 1914, to obtain the necessary powers for the construction of a Kearney high-speed electric railway from the Strand to the Crystal Palace with four intermediate stations. The time to be occupied in the journey is given as 10 minutes, an average speed of 40 miles an hour, including stops, being proposed. The estimated capital expenditure involved is £2,400,000.

According to the *Globe*, it is also proposed to reintroduce the proposal for a mono-railway between London and Brighton, which failed to obtain Parliamentary sanction five years ago.

**Manchester.**—Motor-'buses.—The Tramways Committee of the Corporation has decided to order four additional motor-omnibuses from the Daimler Co. The price is £870 each.

A petition in regard to the running of first-class cars on the Palatine Road route has been presented to the Tramways Committee, and referred to the Traffic Sub-Committee.

**Mexico.**—The Mexico Tramways Co. has now 200 miles of tramway track in operation in Mexico, all except 15 miles of which is electrically operated.

**New Zealand.**—Some details of the Gisborne battery cars, which have appeared in an Australian contemporary, indicate that they weigh 4½ tons each, and are equipped with two 10-H.P. motors and a 100-cell Edison battery, storing sufficient energy for 85 miles running. The cars each seat 26 passengers, and are said to cost 2d. per mile to run; the initial track is, however, only a mile in length, and obviously more reliable results will be available when the complete line, extending 7 miles, is in working order.

**Ripley.**—The Notts. and Derbyshire Tramway Co.'s line from Ripley to Nottingham is now rapidly approaching completion, and a trial run has been made from Langley Mill to Cinder Hill. From the latter point into the city the line has not yet been laid, and between Codnor and Ripley it is still unfinished.

**Rotherham.**—The T.C. has decided in favour of the tramway track in Fitzwilliam Road being relaid with a double instead of a single line, as recommended by the Committee.

**Walthamstow.**—Annual Report.—The accounts of the tramways undertaking for the year ended March 31st last, show that the expenditure amounted to £41,051, as compared with £37,399 for the previous year. After meeting interest on loan repayments amounting to £8,782, the year's working resulted in a deficit of £2,865. A comparison with the previous year, when there was a surplus of £1,800, shows that the expenditure has increased by £3,651, and the income decreased by £1,014, resulting in an adverse difference of £4,666 on the working for the year under review. The deficit of £2,865 will be made up from the reserve fund account, but having regard to the amount that will have to be provided for superseded work in connection with the alterations to the permanent way, the reserve fund will be wholly depleted, and any deficiency in the year ending March next will become a charge upon the rate. The amount of the reserve fund at the commencement of the year was £2,757, and the sum of £1,800, the surplus of the previous year, together with the interest earned, amounting to £129, increases the reserve fund at the end of the year to £4,687. The tramways manager, in his annual report, say "for the first time since the inauguration of our tramway system, eight years ago, I have to report a retrogression in the affairs of the department. In common with all similar undertakings in the Metropolitan area, during the past year we have had to meet severe motor-'bus competition, and this—combined with an exceptionally poor summer—decreased our receipts and increased our expenditure, so that the year's working showed a net loss of £2,800. Up to the end of May, 1912, our receipts were in advance of the previous year by over £400, but during the summer months they dropped over £1,300. Allowances must be made for the Easter holidays falling in March this year, but even then it is evident that during the winter months the greater size of our cars, as compared with the 'buses, has given us a marked advantage over the latter." During this year a charge of 1¼d. per unit was made for traction energy, and the manager considers that 1d. per unit would be a fair and reasonable price, and this difference in price would mean a saving of £2,229. 11,807,549 passengers were carried, as against 12,049,323 in the previous year, a drop of 241,744. The car-miles run amounted to 1,151,029, as against 1,004,872 in 1912, an increase of 146,157. The average receipts per car-mile were 7·90d., as against 9·31d. during the previous year, a drop of 1·41d. per mile.

**Walsall.**—The Corporation Tramways Committee proposes to construct a tramway siding in St. Paul's Street and Darwell Street, at a cost of £500, to alter and extend the tramway offices on the Bridge, at a cost of £1,250, and to provide a tramway shelter on the Bridge, at a cost of £300, all three items to be charged to revenue account.

**Whitby.**—The U.D.C. has confirmed a proposal to apply to the L.G.B. for a provisional order, authorising, among other works, the provision of a cliff tramway.

## TELEGRAPH and TELEPHONE NOTES.

**Norwegian Marconi Station at Stavanger.** — It is reported from Norway that a large number of men are now employed in connection with the construction of the Marconi station at Stavanger. The masts are to be supplied by an English firm, and will be 10 in number. For the foundations about 3,000 cb. metres of concrete will be used. The work of erection of the telegraph and telephone lines, which are to be connected with the station, is also in full swing.

**Argentina.** — According to the *Review of the River Plate*, in order to commemorate the National anniversary, the National Telegraph Department, on July 9th inst., effected direct duplex communication between Jujuy and Puerto Rio Gallegos (Santa Cruz) which passed through the 14 provinces and the territories of the Chaco, Rio Negro, Chubut and Santa Cruz, a distance of 8,747 kilometres. Duplex instruments of the Argentine model were used; 18 translation stations intervened.

**Cable Rates.**—The Postmaster-General has sent a letter to the British Empire League, in which, according to the *Financial News*, he says:—"Arrangements are being made to secure Government control over the rates charged by the cable companies, through their licences to land cables. The proposal is that, whenever such a course appears necessary, the rates should be fixed by the Government at whatever amount appears reasonable with reference to the company's receipts and expenditure, and that in the event of difference, the matter should be referred to arbitration." Our contemporary, commenting on the matter, says:—"It is quite in accordance with Socialistic practice to seize a prosperous company by the throat, but for the Government officials to be endowed with power to examine cable companies' books, and determine whether too great a profit is being earned, while the only remedy a company has is to agree to arbitration, seems to us to be preposterous, and absolutely unjustifiable. Investors in cable companies have worries enough now, seeing that they have the nightmare of wireless constantly before them; but that the fruits of their enterprise should be at the mercy of a Government interested in a competitive system surely requires explanation. If a cable company can effect economies, and thereby render the use of its capital more profitable, it is to be unwarrantably penalised."

The *Financial Times*, commenting upon the matter, remarks that the Stock Exchange "has accepted with perfect equanimity the statement made by the Postmaster-General." "It is believed in expert circles that the object Mr. Samuel has in view is to obtain some sort of control over those enterprises which are entering into alliances with foreign undertakings, the effect of this policy being to reduce the amount of genuine competition, and is regarded with disfavour by the Post Office; for this view there is

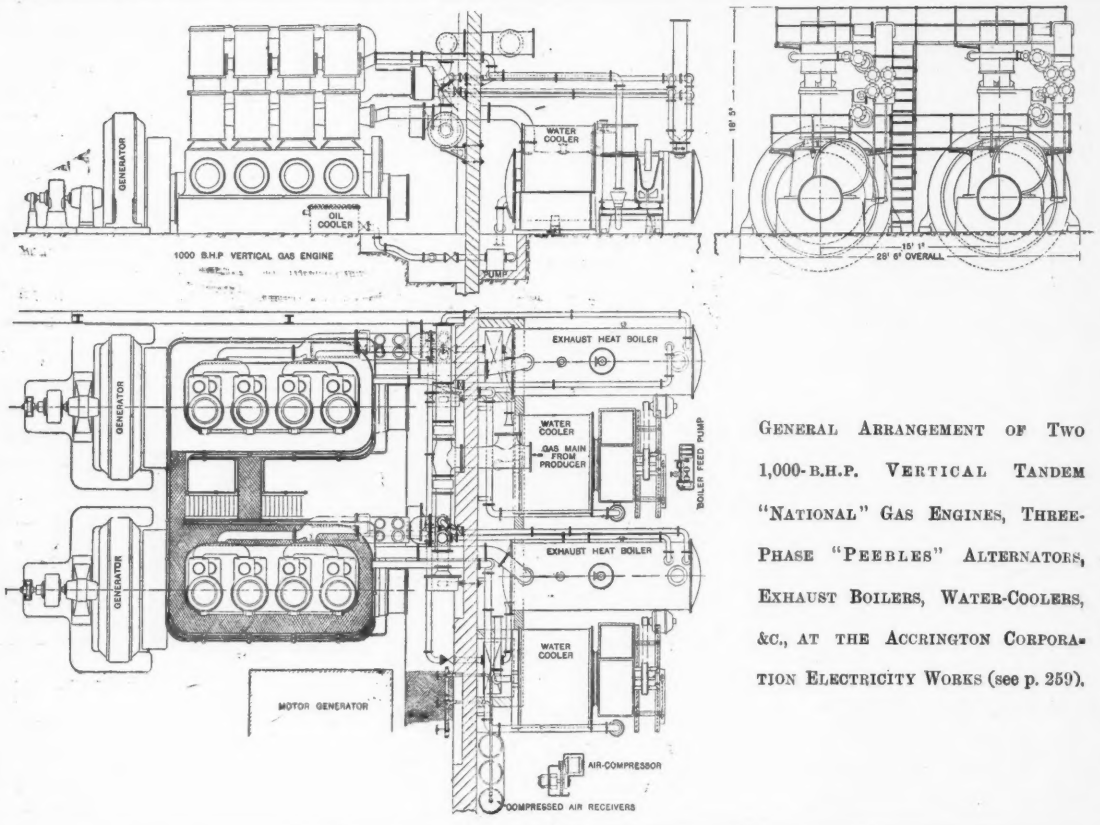
a good deal to be said. In the event, therefore, of these tactics being continued, a strict watch will be kept on the situation by the British authorities with a view to seeing that the interests of the public are not prejudiced. That we are on the eve of a further cutting down of cable charges is generally believed, but this would have occurred without any action on the part of the Postmaster-General. The result of his statement of policy will probably be, however, to bring into the list of companies adopting this policy some which might otherwise not have appeared there, while any schemes now on foot for a consolidation of interests between competing companies, with a view to maintaining tariffs, will probably be postponed."

**London Clocks.**—It appears that of the 100 private clocks fixed above streets in the City, 42, an increase of seven during the year, are electrically synchronised. Not one of the 29 church clocks is synchronised.

**Spain.**—The Compania Nacional de Telegrafia sin Hilos has made application to the Minister of Public Works, for a grant of land at El Patero, Malaga, for the erection of a wireless station.—*Electron.*

**Telephone Finance.**—A Government return dealing with the development of the telephone system, shows that, including £3,000,000 estimated expenditure for 1914, the total sum expended on the telephones since 1893 is £17,085,520, and this statement is exclusive of the purchase money for the plant, &c., of the National Telephone Co.—some £12,000,000.

In reply to a question in the House of Commons, the Postmaster-General said that a new £10,000,000 loan was intended for capital expenditure on new plant for extension and development of the service, and no part is to be employed for reduction of telephone subscriptions. The Bill providing for the issue out of the Consolidated Fund was introduced by Mr. Samuel last week. It provides for borrowing by means of terminable annuities for a term not exceeding 20 years, or by the issue of Exchequer Bonds.




General Arrangement of Two 1,000-b.h.p. Vertical Tandem "National" Gas Engines, Three-Phase "Peebles" Alternators, Exhaust Boilers, Water-Coolers, &c., at the Accrington Corporation Electricity Works (see p. 259).

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.** — Brisbane.—September 24th. Ironwork, cast-iron pipes, iron poles, galvanised iron wire, for the P.M.G. See "Official Notices" to-day.

Canberra.—September 1st. Commonwealth Department of Home Affairs. Switchgear for the power house at Canberra, the new Federal Capital in New South Wales. (1) Main power house switchgear; (2) Diesel engine switchgear. Tenders to the Secretary, Department of Home Affairs, Russell Street, Melbourne. Tenderers must state the earliest time of delivery. Deposit of 1 per cent. A copy of the specification, &c., together with a blue print, may be seen by United Kingdom manufacturers at the Commercial Intelligence Branch of the Board of Trade, London, E.C.

Perth.—October 8th. Bolts for the P.M.G. See "Official Notices" to-day.

The *Australasian Record* announces the following open contracts:—

Sydney.—August 27th. Supply of telephones, lamps, electric, incandescent, and switchboards.

Melbourne.—October 14th. Supply of common-battery switchboard.

October 7th. Postmaster-General's Department. S. and I. of electrically-driven machinery for operating pneumatic tube services, Central Telegraph Office; Schedule No. 900.

Melbourne Suburbs.—November 4th. Supply of eight automatic telephone switchboards.

**Bacup.**—The Electricity and Tramways Committee has decided to obtain tenders from cable manufacturers for supplying alternatively '05 size, '075 size or '1 size H.T. cable. The manufacturers are to be asked to quote a separate price for the laying, jointing and other work of connecting up the mains, and for this latter work the Rawtenstall Corporation is also to be asked to quote.

**Belgium.**—August 19th. The municipal authorities of Schaerbeek, near Brussels, are inviting tenders for the contract for the supply of high-tension current. Particulars may be obtained from the Service de l'Electricité, 30, Rue de la Ruche, Schaerbeek.

The municipal authorities of Glain, a small town in the Province of Liége, have just invited tenders for the concession for the supply of electrical energy for private and public lighting and power purposes.

Brussels.—August 22nd. The municipal authorities are inviting tenders for the supply of circuit-breakers. Deposit 1,000 fr. Cahier des Charges, 0 fr. 50 c.

**Bournemouth.**—August 27th. Reconstruction of 3 miles (single track) of permanent way for the Corporation Tramways Department. Mr. I. Bulfin, tramway manager. Deposit for specifications, £2.

**Bradford.**—August 30th. Machinery and timber, for the Corporation Tramways Department. See "Official Notices" August 8th.

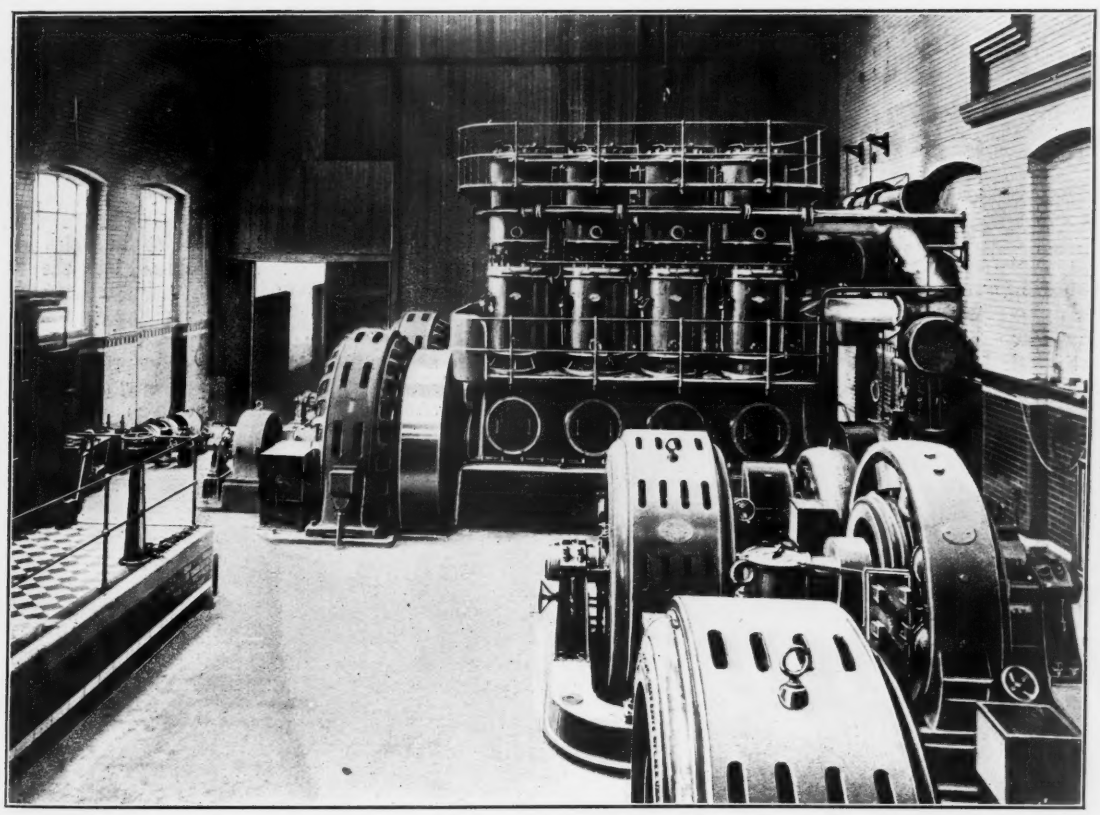
**Bury.** — August 25th. One 2,000/3,000-kw. turbo-alternator, with exciter and surface condenser, for the Corporation. See "Official Notices" August 1st.

(*Continued on page* 264.)

# GAS-ELECTRIC AND BY-PRODUCTS RECOVERY PLANT AT THE ACCRINGTON ELECTRICITY WORKS.

Although some years have now elapsed since Messrs. Andrews and Porter brought forward so strikingly the possibilities of the large gas engine, working in conjunction with producer and by-product recovery plant, for generating electricity,* we have not noticed any pronounced movement in favour of their adoption by British central station engineers. But at least one borough electrical engineer—Mr. Harold Gray, of Accrington—has boldly left the beaten track, and launched out on a gas engine scheme of some magnitude, and judging by his experience of its working, he is to be congratulated on his choice of plant.

Speaking generally, the suitability or otherwise of gas-engine plant depends entirely on the working conditions which will have to be met; under steady and continuous load conditions—such as exist in the case of the Accrington gas engines—such plant working in conjunction with producers and ammonia and tar recovery plant, enables exceptionally low generating costs to be secured, the cost of fuel being either negligible or comparatively small.



1,000-B.H.P. Vertical Gas Engines at the Accrington Electricity Works; Motor-Generators in Foreground.

At Accrington the producer and recovery plant is installed on land lying 100 yards or so behind the present steam generating and destructor station, and if the two 1,250-I.H.P. producers and auxiliaries are regarded as a unit, six such units could be accommodated on the space available, while sufficient ground remains to extend the present engine room to accommodate suitable engine power.

The lay-out of the gas plant—which was supplied by the Power Gas Corporation, Ltd., of Stockton-on-Tees—is shown diagrammatically on page 263; the producers, which are run on local bituminous coal, costing 13s. 6d. per ton, are of the Mond pressure type, provided with water bottoms, and fitted with wide fire-bars of the standard Mond pattern.

Coal is delivered to a hopper below the road level, and lifted to the top of the bunkers by means of a bucket elevator, which delivers on to a distributing conveyor running over the bunkers. From the latter the coal falls into 4½-cwt. measuring hoppers, which discharge into the producer bells.

The gas from each producer is led through a tubular superheater to a common collecting main; in passing through the superheaters the hot gas raises the temperature of the steam and air supply to the producers to 225° C.; the lower ends of the superheaters form dust-catchers, where the fine dust carried over with the gas is discharged at intervals.

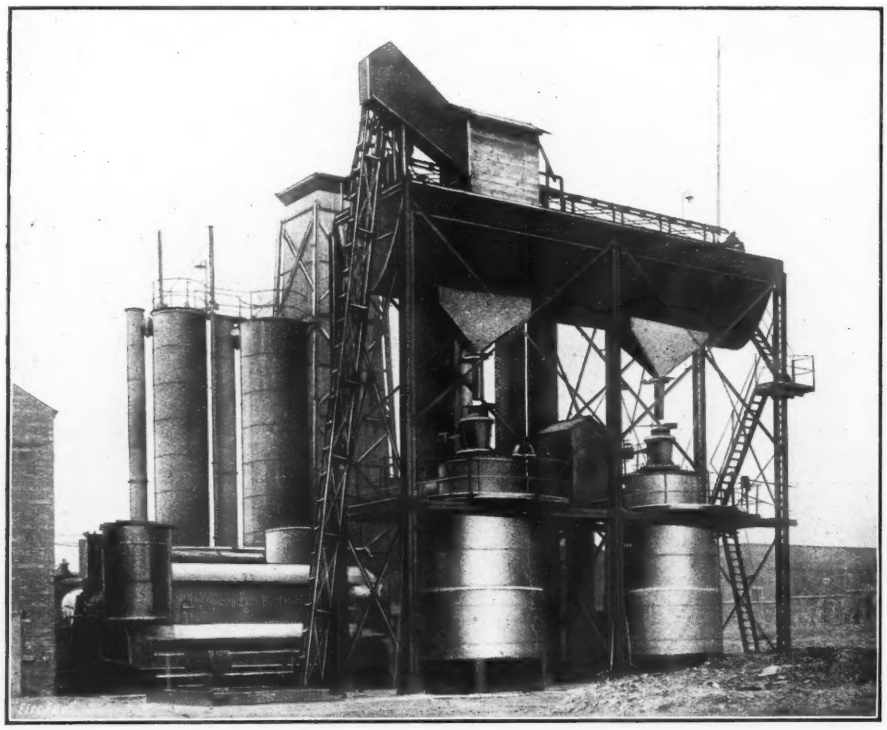
From the collecting main the gas, at a temperature of 400° C., passes through a washer, the interior of which is filled with fine water-spray produced by two revolving dashers, and the sooty matter deposited is removed through lutes at the side; the gas, reduced in temperature to 80° C., then passes through a spray arrester fitted with baffles, to an ammonia absorber, also containing two revolving dashers which, in this instance, produce spray from a liquid consisting of a solution of ammonium sulphate with about 2 per cent. of free sulphuric acid.

The acid in this solution combines with the ammonia in the gas to produce sulphate of ammonia. The process is continuous, and hence, as the liquor becomes augmented in strength, a certain portion is, from time to time, drawn off to a stock tank, and the remainder in the absorber made up to the required volume with added water.

From the absorber the gas passes through a second spray

* I.E.E. paper. See Elec. Rev., February 19th, 26th, March 5th, 1909.

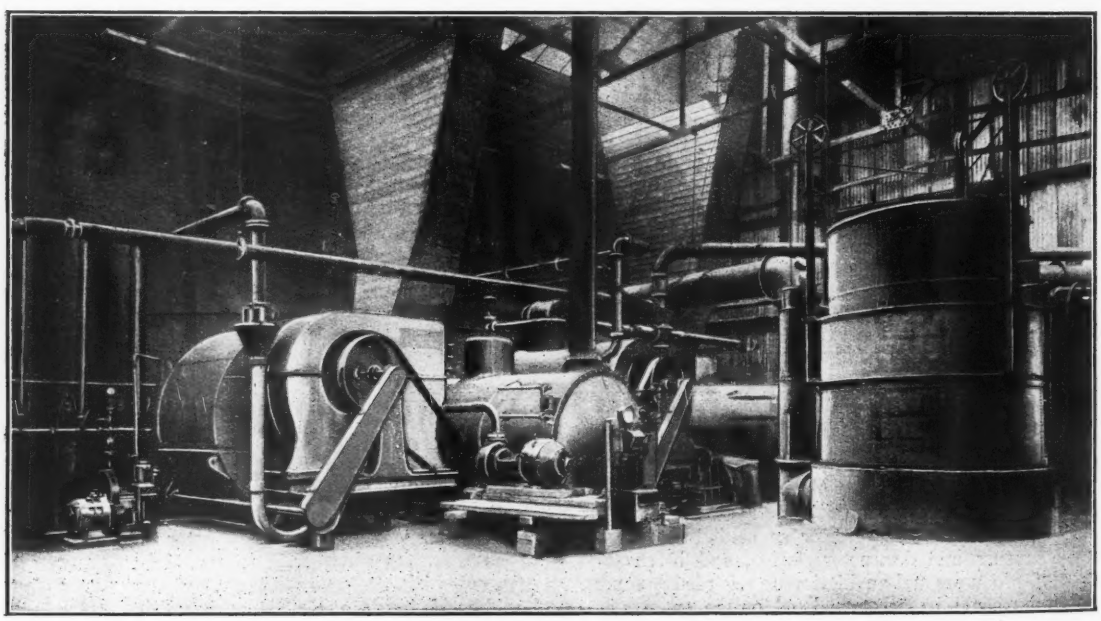
arrester and two vertical coolers—in which it meets cold water sprays and deposits the bulk of its tar—to a gas governor consisting of a small sensitive gas holder, the rise and fall of which—depending on the rate at which gas is being used—controls the supply of pressure-air to the producers through the medium of a butterfly valve, which allows more or less of this air to be discharged to atmosphere.



Mond Gas Plant, with 1,250-h.p. Producers in Foreground; Accrington Electricity Works.

The gas next passes through two centrifugal cleaners and a sawdust scrubber to the 18-in. gas main running to the engine house, prior to entering which, however, it is metered in a rotary meter and passed through an anti-pulsator—another small gas holder similar to that already mentioned. The centrifugal cleaners which run at 1,400 r.p.m., perform a triple function, as, in addition to removing all but a trace of the remaining tar (the trace being removed in the scrubber), they also cool the gas further and raise its pressure sufficiently to give a small reserve for working the anti-pulsator. The tar from centrifugal cleaners, as also that from the coolers, passes out through water-sealed pipes to settling tanks, and is finally collected, steam heated in a boiler to get rid of excess water and sold at about 10s. per ton to neighbouring chemical works.

The air blast for the producers is obtained from two No. 3 Roots blowers coupled to high-speed steam engines, and shown in one of our views; the air at 45 cm. water pressure is passed through an air-heating tower, where it meets jets of the hot water which has been returned from the first gas cooling tower, taking up a proportion of water vapour and being raised in temperature. A considerable quantity of steam is also introduced into the blast (roughly 2½ tons, which includes ¾ ton from the air tower per ton of fuel gasified) prior to its being superheated to about 225° C. and entering the producers. The steam limits the temperature of the producer, preventing the formation of clinker and destruction of the ammonia.



Exhaust Boilers, Heenan Cylinder-Water Coolers, Anti-Pulsator, &c.; for Two 1,000-b.h.p. Gas Engines.

The blower house also contains four small motor-driven centrifugal pumps, for circulating the water through the two gas-cooling towers, the water-cooling tower, which works in conjunction with them, and the air-heating tower; a gauge board is also provided here, containing nine wate

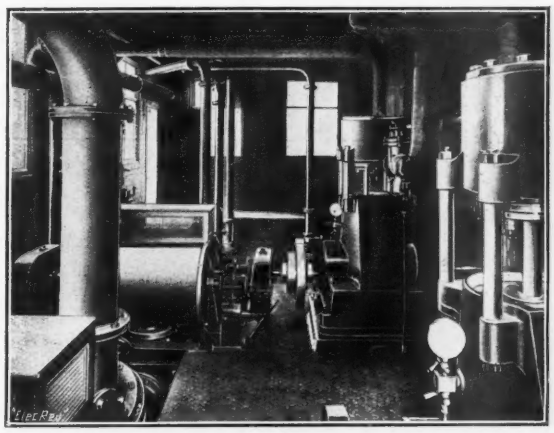
gauges connected to various portions of the plant, the indications of which are logged at regular intervals, and show how the plant is working.

The ammonia liquor from the stock tank is lifted by means of an ejector to a feed tank in the sulphate house, being drawn off and boiled in a vacuum evaporator until it begins to crystalise; these crystals are subsequently withdrawn and dried in a hydro-extractor, the product known as grey sulphate being sold for about £12 10s. per ton. At the present time about 85 tons of coal per week is being gasified and as by-products, 3¾ tons of sulphate and 10 tons of tar are obtained. The clean gas is delivered to the engines at 7 cm. water pressure and 25° C. temperature.

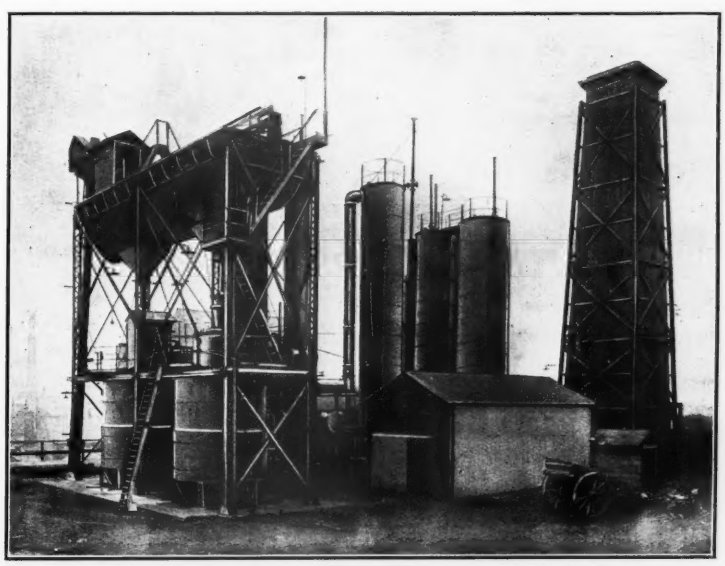
The gas plant is worked in conjunction with a fully equipped chemical laboratory where daily tests of the fuel, gas, and by-products are carried out. Turning to the engine house, there are installed two 1,000-B.H.P. National gas engines, direct-coupled to 938-K.V.A. Bruce Peebles alternators, and 12-KW. exciters, running at a speed of 200 R.P.M. The alternator windings were specially impregnated and large creeping surfaces provided on account of gas fumes. The engines, as shown in our views, are of the four-crank vertical enclosed pattern, each having eight cylinders arranged in tandem pairs, the lower ones 22 in. diameter, and the upper ones 23 in. diameter, to allow of the lower pistons being easily withdrawn.

Two low-tension Bosch magnetos are provided to each engine supplying independent sparking plugs on each cylinder.

The air for the engines is drawn in through admitters in the engine room, which are silent in action, and is mixed with the gas at the cylinder head.



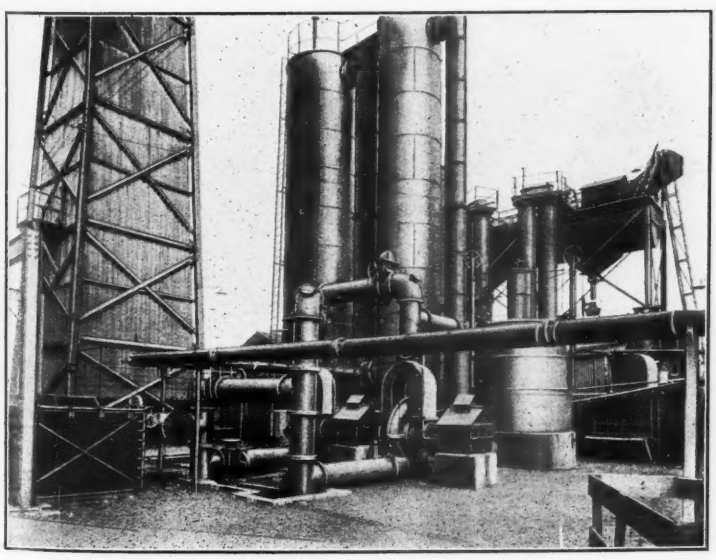
Roots Blowers for the Mond Producer Plant.



General View of the Accrington Producer Plant, with Blower House in Foreground.

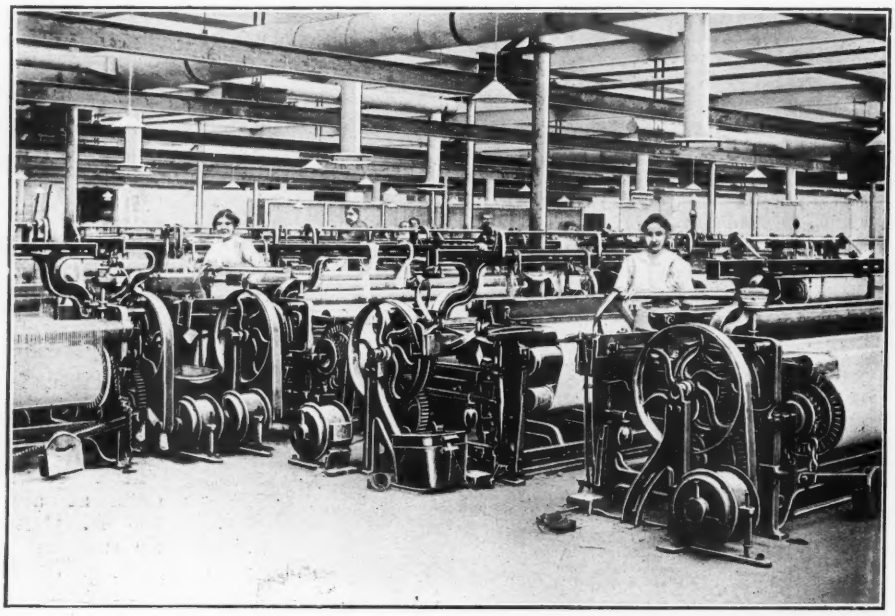
The exhaust from each engine is passed through a special loco.-type boiler, which generates steam at about 100 lb. pressure, for supplying the needs of the producer plant, and effectively silences the escaping gases; the cylinder cooling water from each engine is circulated through a Heenan cooler—an ingenious apparatus consisting practically of a large plate coiled in the form of a watch spring, which in revolving slowly abstracts the heat from the water, and is in turn cooled by means of air blown on to it.

The boilers and coolers are situated in the original boiler house, together with the anti-pulsator and three compressed-air starting tanks for the gas engines; a small motor-driven compressor charges up the starting tanks to a pressure of 300 lb. per sq. in., and together with the other apparatus is shown in our views on pages 258 and 260. The Accrington gas engines have now been running about nine months, and supplying a very large proportion of the load on the station, which is rapidly growing during the day owing to the number of textile and machine works which have taken up electric driving; one of the engines runs throughout the 24 hours of the day, while the other runs during factory hours, *i.e.*, 6 a.m. to 5.30 p.m., and together they generate about 120,000 units per week at the present time. The fuel consumption under these conditions is rather more than 1½ lb. per unit, costing about ·125d., and against this there is to be credited from the sale of by-products about ·07d. per unit, leaving a fuel cost of some ·05d. per unit generated. The gas engine plant generates three-phase 50-cycle



Centrifugal Cleaners and Gas Cooling Towers behind, Governor, Ammonia Absorber, &c. (Left to Right.)

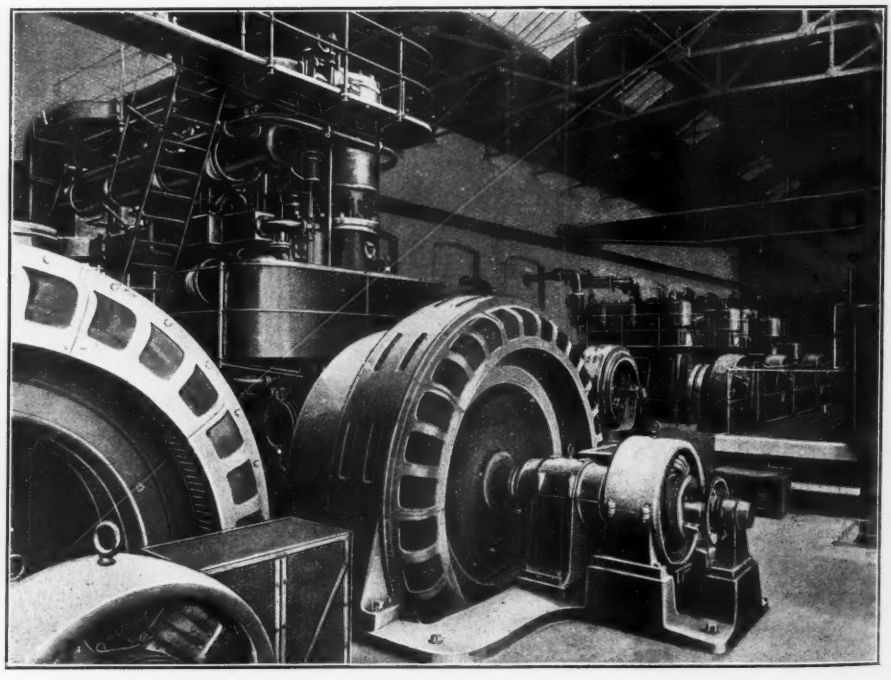
current at 6,000-6,600 volts, and is linked up to the older high-speed direct-current steam generating plant through one 270-H.P. and two 570-H.P. G.E.C. motor-generators, an arrangement which allows for the economical distribution of the load between the steam and gas plant. The 6,600-volt feeder system extends about 2 miles in a northerly direction to Clayton-le-Moors, where there is a static sub-station containing three 250-KW. transformers for supplying a three-phase four-wire network at 230 and 400 volts; negotiations have been practically completed for extending the E.H.T. supply to Great Harwood, about $1\frac{1}{2}$ miles beyond Clayton, where it is proposed to give a supply in bulk. The Clayton feeder is looped into a 300-KW. static sub-station at a local brick-works, where a 260-H.P. motor is in use for running a brick-making plant. Duplicate E.H.T. feeders also extend some $5\frac{1}{2}$ miles south to Haslingden, where a bulk supply is given to the local council through a static sub-station containing two 250-KW. transformers; *en route* these feeders supply a 450-KW. sub-station at Messrs. Howard & Bullough's machine works, also static sub-stations at the Albert Mill (120 KW.) and Messrs. Higham's mill (250 KW.); both feeders also pass through a rotary sub-station at Oak Hill, containing two 250-KW. induction motor-generators for supplying in the locality, which, in common with the rest of the Accrington area, is supplied through a direct-current three-wire network.



A Corner of Messrs. Higham's Weaving Shed Equipped with Individual Drive and Supplied from the Accrington E.H.T. Mains.

Through the kindness of Mr. T. E. Higham—whose close connection with the Accrington Electricity Committee in his capacity of chairman, would appear to be a matter for congratulation—we were able to inspect the fine individual drive installation which that gentleman has introduced in connection with the weaving and allied departments of his mill.

Some 400 heavy sheeting looms are installed, each driven by its own three-phase 200-volt motor, of $\frac{2}{3}$ to 1 B.H.P., and about 970 R.P.M. speed. The motors are of the Schorch type, fitted with ball bearings and $2\frac{3}{4}$ in. pulleys, with belt drives on to 24-in. pulleys on the looms, an arrangement which gives both satisfactory starting and running. The Schorch Co. carried out the whole of the electrical equipment, which included a sub-station (originally the engine room), and the whole of the wiring, as well as the motors, &c. From the sub-station a central rubber-covered feeder runs in steel piping under the concrete floor of the shed; at intervals there are 11 distribution boxes where the feeder cables are tapped off, and from which they are carried in steel piping to the side distributors, also in pipes under the floor, branch off on either side. A series of sub-distribution boxes, in fact, one to each four loom motors, is provided in each of the side distributors, the motor leads passing out through Zed fuses and small



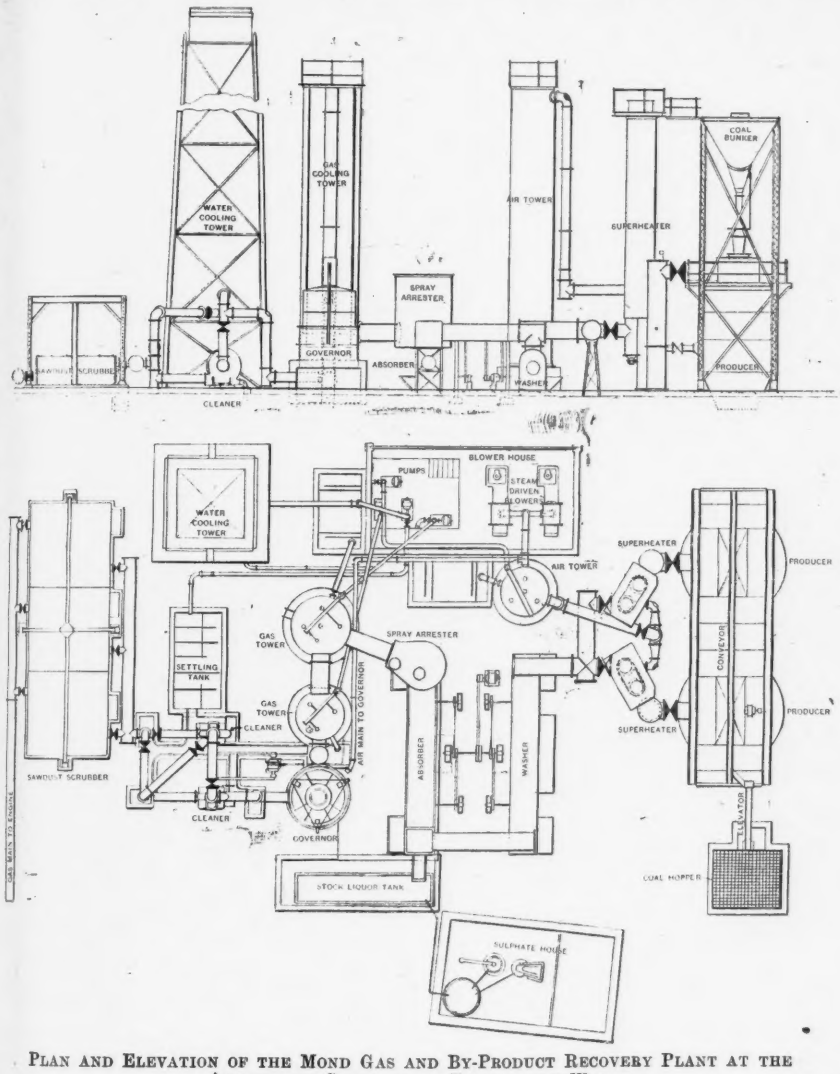
Accrington Electricity Works; Gas Engine Driven Alternators on the Left and Steam Plant in the Distance.

pipes to above floor level. Our view shows a corner of the shed with loom motors in the foreground; the ventilating ducts in the roof connect to an electrically-driven humidifying plant.

The installation ought to be an object lesson to local mill owners, as we believe it is to the employés, for whom Mr. Higham has introduced electrical heating and water-boiling apparatus.

During the year ending March 31st last, the Accrington electricity department sold about 4,840,000 units, of which 3,084,000 were sold for power purposes, showing an increase of 1,350,000 units during the 12 months, and the indications are that this year's working will show equally favourable progress.

In conclusion, we are indebted to Mr. Harold Gray, for enabling us to place on record some particulars of a most interesting municipal development.




Plan and Elevation of the Mond Gas and By-Product Recovery Plant at the Accrington Corporation Electricity Works.

**The Half-watt Lamp in America.**—According to the *Electrical World*, as a result of investigations made in the research laboratory of the General Electric Co. at Schenectady, N.Y., for the past few years, there has been produced a metallic-filament lamp which operates at the low specific consumption of 0·5 watt per candle, the efficiency being about twice that of the best incandescent lamps heretofore available. The new lamp contains a specially shaped tungsten filament, and is filled with an inert gas, such as nitrogen, at a pressure of about an atmosphere. The types which it is expected to develop first are adapted to comparatively high current consumption—6 amperes—and above. The new lamps promise to be of particular value in a field not heretofore covered by incandescent lamps, and should greatly broaden the applications in which they can be used advantageously, particularly in the direction of very large candle-power units.

## SOME RESULTS OF OVER-PRODUCTION.

[An Essay in Political Economy.]

[communicated.]

At a time when nearly every industry in the country is thriving, when orders have to be executed abroad because there are no hands free to do the work at home, it is not unprofitable to consider some of the aspects of excessive production from the point of view of political economy. "Take no thought for the morrow," is a precept familiar to us all; but like many another utterance from Holy Writ, it must not be too literally interpreted.

In no industry is the study of the phenomena of over-production more necessary than in that with which this journal is primarily concerned. Ours is an industry of modern conception and rapid growth. So rapid is that growth, so fertile the mind of the electrician in devising improvements, that the life even of the most modern types of machinery is by no means long. We do not mean that modern machinery is of necessity soon worn out. Say rather that it rusts out. Being supplanted and superseded, it is of necessity consigned to the scrap-heap.

It is to the scrap-heap in its larger sense that he who desires to consider the phenomena of over-production should turn. His investigations will prove interesting. It is said of an American who was invited to inspect a large engineering works in this country, that his first request on entering the premises was "Show me the scrap-heap." And he found so much to interest him at that corner of the premises, that he found no time to extend his visit to any other department!

That over-production is a normal incident in nearly every industry was early recognised by the political economists. As John Stuart Mill wrote in his "Principles of Political Economy" (Bk. III, Cap. XIV, Sec. 1), "Dearth, or scarcity on the one hand, and over-supply, or, in mercantile language, glut, on the other, are incident to all commodities. In the first case, the commodity affords to the producers or sellers, while the deficiency lasts, an unusually high rate of profit; in the second, the supply being in excess of that for which a demand exists at such a value as will afford the ordinary profit, the sellers must be content with less, and must, in extreme cases, submit to a loss."

The phenomenon of over-production is so well recognised that some political economists have recommended the adoption of certain remedies. Thus, Dr. Chalmers has suggested the practice of a moral restraint in reference to the pursuit of gain; while Sismondi deprecated the use of machinery and the various inventions which increase productive power. These two *savants* have urged that accumulation of capital may proceed too fast, not merely for the moral, but for the material interests of those who produce and accumulate; and they enjoin the rich to guard against this evil by an ample unproductive consumption.

It is well to observe, however, that John Stuart Mill took a very cheerful view of the accumulation of capital. He wrote: "Until the working classes have reached the point of satiety there will be no want of demand for the produce of capital, however rapidly it may accumulate; since, if there is nothing else for it to do, it can always find employment in producing the necessaries or luxuries of the labouring class. And when they, too, have no further desire for necessaries or luxuries, they would take the benefit of any further increase of wages by diminishing their work; so that the over-production which then for the first time would be possible in idea, could not even then take place for want of labourers." "Thus," concludes Mr. Mill, "in whatever manner the question is looked at, even though we go to the extreme verge of possibility to invent a supposition favourable to it, the theory of general over-production implies an absurdity.

"The true interpretation of the modern, or present, state of industrial economy, is that there is hardly any amount of business which may not be done, if people will be content to do it on small profits . . . . but even those who comply with the necessities of their time, grumble at what they comply with and wish that there were less capital, or, as they express it, less competition in order that there might be greater profits."

Your modern electrical engineer, who is concerned with the severely practical side of electrical industry, will scarcely adopt the means suggested for stopping over-production. Let him abandon labour-saving machinery, and he will be in a welter of labour troubles. Let the rich be enjoined to indulge in ample unproductive consumption: bankruptcy would then stare the electrical, as well as many other industries in the country, fairly in the face.

## CONTRACTS OPEN.

(*Continued from page* 258.)

**Doncaster.**—The Tramways Committee has recommended the purchase of 200 tons of tramway rails.

**Dublin.**—August 26th. Feed pump, cast-iron tanks, pipe-work, valves, steam separators, boiler house shutters, coal grab and steel work, for the Corporation. See "Official Notices" August 1st.

August 26th.—Supply of A.C. meters, single-phase and three-phase, for two years, for the Corporation. See "Official Notices" to-day.

**Egypt.**—October 31st. Egyptian Ministry of the Interior. Machinery and plant required for the installation of electric light in the town of Damanhour. See our last issue for particulars.

**France.**—PARIS.—August 18th. The State Railways Administration (2e division, 43, Rue de Rome) invites tenders for the supply of electrical material for the traction sub-station at Porchefontaine, in two lots.

**Germany.**—September 22nd. The Hafenbauamt at Bremen is inviting tenders for the supply of 22 electrically operated cranes of 2½ tons capacity each.

**Halifax.**—August 19th. 200 tons tram rails, for the Corporation Tramways Committee. Borough Engineer.

**Hungary.**—Tenders have just been invited by the municipal authorities of Gyoma for the establishment of a central station in the town for electric lighting and power purposes.

**Hyde.**—August 21st. Corporation. Electric light fittings, electric ventilating fans, &c., for the Corporation Baths extension. Architect, Mr. J. H. Fletcher, 45, Clarendon Place, Hyde. Tenders to Mr. Thomas Brownson, Town Clerk.

**London.**—GENERAL POST OFFICE.—September 1st. Stores Department. (1) Supply of Swedish, Norwegian, Finland or Russian red fir telegraph poles; (2) creosoting, &c., telegraph poles. Mr. G. Morgan, Controller of Stores, 17-19, Bedford Street, W.C.

L.C.C.—August 25th. Electrical installation, 320 lighting points, for Middle Row School, Kensal Road, N.W. See "Official Notices" August 8th.

September 1st.—Electrical installation (100 lighting points), for the L.C.C., at Royal Hill Central Elementary School, Greenwich, S.E. See "Official Notices" to-day.

**Plymouth.**—August 27th. Steam turbo-alternator, condenser, &c., for the Corporation. See "Official Notices" July 25th.

**Malvern.**—The U.D.C. has decided to invite tenders for a year's supply of coal to the electricity works.

**Manchester.**—August 18th. Cables for the Electricity Committee. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

**Rochdale.**—August 27th. The Electricity Department invites tenders for steam coal, cartage of coal and removal of ashes, supply and erection of wet-air filter, and circulating water screens. Specifications, &c., from Mr. C. C. Atchison, engineer and manager, Dane Street, Rochdale, £1 1s.

**Servia.**—August 23rd. The Servian Post and Telegraph authorities in Belgrade are inviting tenders for the supply of 100 tons of iron wire, 46 tons of siliceous bronze wire, and a quantity of telephone cable.

**Shanghai.**—August 26th. Two 5,000-KW. steam turbo-alternators, complete with surface-condensing plant; four water-tube boilers, with integral superheaters, mechanical stokers, economisers, &c., for the Municipal Council. See "Official Notices" July 25th.

**South Africa.**—August 26th. 36,000 metal-filament lamps, for the S.A. Railways Administration.

**Spain.**—August 29th. Tenders are being invited by the municipal authorities of Cuevas de San Marcos (Province of Malaga) for the concession for the electric lighting of the town during a period of 20 years.

September 11th.—The municipal authorities of Castellon de la Piana are inviting tenders for the installation of a generating station.

**Wakefield.**—September 1st. Water-tube boiler, superheater, stoker, steam turbo-alternator, condensing plant, H. and L.T. switchgear for the Corporation. See "Official Notices" August 1st.

**Wimbledon.**—September 1st. One 1,500-KW. turbine alternator, condensing plant, auxiliaries, and 20-ton crane, for the Corporation. See "Official Notices" August 8th.

**York.**—August 25th. Coal for a year from September 30th, for the Corporation electricity works (about 10,000 tons, either unscreened beans, pea slack, rough slack or small peas). Mr. J. W. Hame, engineer and manager, Clifford Street.

## CLOSED.

**Atherton.**—The U.D.C. has accepted the tender of the Callender's Cable and Construction Co. for extra-high-tension cables.

**Australia.**—The placing of the following contracts is announced by the *Australian Mining Standard and Electrical Record*:—

West Australia, Railways Department—
W.E. magnetos, induction coils, &c., Unbehaun & Johnstone.

Melbourne Harbour Trust Commissioners—
E.L. installation for dredging and transport service, £512, Clayton, Joel & Co.

N.S.W. Public Works Department, Harbour Works—
Three 82-K.V.A. motors for Newcastle workshops, £1,059, Australian General Electric Co.

Victorian Railways—
80-KW. A.C. transformers, £61, Australian G.E. Co.

P.M.G., Western Australia—
Three miles paper-insulated lead-covered telephone cable, £214 per mile, W. T. Henley's Telegraph Works Co.
Distributing boxes (330), 17s. 3d. and 19s. 6d. each, James & Co., Ltd.
" " " (330), 14s. 10d. and 29s. 8d. each, G. Stirzacker.
"Hargis" cable-jointing boxes, G. Kent, Ltd.

City of Melbourne—
Reactance coils for 4,400-KW. turbines, £963, c.i.f. Melbourne, Siemens Bros. Dynamo Works, Ltd.

Municipal Council of Sydney—
Rubber-insulated cable, £551, with an allowance of 0·175 per cent. in the price up or down for every £1 per ton rise or fall in the market price of copper, and 1·05 per cent. in the price for every 1d. per lb. rise or fall in the market price of rubber between July 23rd and the date of receipt of notification of the acceptance of the tender, Noyes Bros.

**Belgium.**—The Belgian military authorities in Liége recently invited tenders for the supply and laying of a series of electricity mains at 12 forts in the Liége district and nine in the Namur area. Three firms tendered for the order, the lowest offer being that of Messrs. Dehousse & Co., of Saint-Josse-ten-Noode. A contract for 42 dynamos and 21 switchboards for the forts in the Meuse district fell to La Société Belge d'Appareillage Electrique Goerdy, of Mons, and one for 37 electric motors to La Société Electrique la Campine, of Brussels.

One French and four German concerns submitted tenders last week to the Belgian Post and Telegraph authorities in Brussels for

the supply of two telephone cables between the Belgian capital and Antwerp, the lowest offer being that of the Rheydt Kabelwerk Gesellschaft, of Rheydt, Westphalia. The same concern also sent in the lowest tender for two telephone cables between Ans and Verviers.

**Blackburn.**—The T.C., on August 7th, ordered its seal to be affixed to a contract between the Electric Construction Co., Ltd., and the Corporation, for the supply of electric motors for the electricity department.

**Cape Colony.**—WELLINGTON, CAPE PROVINCE.—The Municipal Council held on July 15th considered the report of the consulting engineer (Mr. Chas. G. Trevett) on the tenders received for the electric lighting scheme. The tender of the British General Electric Co., Ltd., for the complete installation, was accepted, subject to the approval of the Administrator. The amount of the tender, which includes the erection of Hornsby suction gas plant, is £7,486, exclusive of buildings.

STELLENBOSCH, CAPE PROVINCE.—The tender of the A.E G. Co., Ltd., of Johannesburg, for the electric lighting scheme, has been accepted by the Municipal Council.

**Fleetwood.**—Mr. R. Banon has secured the contract for the new installation and re-wiring at the extensive works of the Fleetwood Fish Meal Co. on Wyre Dock.

**France.**—PARIS.—July 31st. Chemins de Fer de l'Etat. The following tenders were submitted for the supply of vulcanised india-rubber articles:—Colonial Rubber Co., 76,954·25 fr.; Hutchinson, 78,618 fr.; Kalker, 98,271·50 fr.; Manufacture Parisienne du Caoutchouc, 71,829 fr.; Casassa, 64,236·40 fr.; India-Rubber and Gutta-Percha Co., 95,939·90 fr.; Société Industrielle des Téléphones, 71,910·19 fr.; Torilhon, 66,718·60 fr.; and François et Cie. (successful), 61,500·25 fr.

**Germany.**—Messrs. De Fries & Co., of Dusseldorf, have secured a contract from the Prussian State Railway authorities at Munster, Westphalia, for the supply and erection of four electrically-operated 5-ton cranes.

**Glasgow.**—The Electricity Committee recommended acceptance of the offer of the British Thomson-Houston Company (£476), for H.T. gear to be erected at Partick Electricity Station.

The offer by the Midland Electric Wire Co., Ltd., for D.C.C. wire has been accepted by the Tramways Committee.

**Hereford.**—The T.C. has accepted the tender of Messrs. Reyrolle & Co. for three starting switches for the electric pumps at the waterworks, at £76.

**Italy.**—The India-Rubber, Gutta-Percha and Telegraph Works, Ltd., of Silvertown, E., have secured a contract from the Italian telegraph authorities in Rome for the supply of 1,300 m. of submarine 13 conductor cable.

**Llandudno.**—The U.D.C. has accepted the tender of Messrs. Thomas Parry & Co., of Mold, for 5,000 tons of slack coal for the electricity works, at 10s. 10d. per ton.

**London.**—For installing the electric light at the Convent of Marie Auxiliatrice, 26, Bow Road, the tender of Mr. W. Morgan, Leytonstone, has been accepted.

**Loughborough.**—The T.C. has accepted the tender of Messrs. Clarke, Chapman & Co., at £1,774, for boiler and superheater at the generating station.

**Manchester.**—The Education Committee has accepted the tender of Messrs. W. P. Theermann & Co., Ltd., for electric lighting installation at Grange Street Municipal School.

The Corporation Electricity Committee has accepted the tenders of the B.I. & H. Cables, Ltd., and W. T. Glover & Co., Ltd., for rubber and aerial cable respectively.

The Corporation Tramways Committee has accepted tenders from the following:—

Tramcar trucks.—Brush Electrical and Engineering Co., Ltd.
Tramcar wheel centres.—Edgar Allen & Co., Ltd.
Block tin.—Stedman, Crowther, Ltd.

The Electricity Committee has accepted the tenders of Messrs. Johnson & Phillips, Ltd., and the Electrical Engineering and Equipment Co., Ltd., for paper cable. The following tenders for the supply of stores required during the ensuing 12 months have also been accepted:—

Asbestos goods.—Witty & Wyatt, Ltd.
Canvas or Hessian.—L. Andrew & Co.
Commercial hydro-acid.—Joseph Brooks & Co., Ltd.
Sulphuric acid.—H. N. Morris & Co., Ltd.
Boiler tubes (land type).—Babcock & Wilcox, Ltd.
" " (marine type).—British Mannesmann Tube Co., Ltd.
Brass and copper work.—Till & Whitehead, Ltd.
Buxton lime.—Buxton Lime Firms Co., Ltd.
Service cables.—Rubber insulated: Henley's Telegraph Works Co., Ltd. Lead-covered paper.—Union Cable Co., Ltd.
Carbons.—Sloan Electrical Co., Ltd.
Cement.—Warrington Slate Co., Ltd.
Cotton waste and rags.—W. C. Jones, Ltd.
Dynamo Brushes.—George Christie, Ltd.
Carbon brushes.—Le Carbone and the Morgan Crucible Co., Ltd.
Earthenware bridges.—Doulton & Co., Ltd.
" pipes, &c.—Stretchers: Isherwood Bros., Ltd. Pipes and bends: Doulton & Co., Ltd.
Firebricks and clay.—Glenboig Union Fireclay Co., Ltd.
Gauge glasses.—Schaffer & Budenberg, Ltd.
India-rubber goods.—L. Andrew & Co.; George Maclellan & Co.; North British Rubber Co., Ltd.; F. Reddaway & Co., Ltd.
Insulators.—Doulton & Co., Ltd.; Sloan Electrical Co., Ltd.; Bullers, Ltd.
Iron and steel.—Hall & Pickles.
Leather belting.—Peter Haworth & Co., Ltd.
Manhole flags and covers.—J. Cunliffe & Co.
Metal polish.—Matchless Metal Polish Co., Ltd.
Engine paste.—G. Maclaren & Co.
Pitch and pitch oil.—Hardman & Holden, Ltd.
Recorder paper.—Elco Recording Press.
Rubber tape.—Jas. North, Hardy & Son; W. T. Henley's Telegraph Works Co., Ltd.; Geo. Hattersley & Sons, Ltd.; Chas. Macintosh & Co., Ltd.; L. Andrews & Co.; I.R., G.P. & Telegraph Works Co., Ltd.
Steam and gas fittings.—John Russell & Co., Ltd.
Wiring cables.—British Thomson-Houston Co., Ltd.
Electrical accessories.—British Thomson-Houston Co., Ltd.; Sloan Electrical Co., Ltd.; General Electric Co., Ltd.
Creosote and common tar.—Hardman & Holden, Ltd.
Paints, &c.—J. E. Williams & Co.
Crucibles.—Morgan Crucible Co.
Anti-sulphuric enamels.—Griffiths Bros. & Co.
Nickel-chrome wire and strip.—Wiggins & Sons.
Tinned steel and armature wire.—W. N. Brunton & Son.
D.C.C. silk-covered and Eureka wires.—London Electric Wire Co. and Smith's, Ltd.
Enamelled wire.—Connolly Bros., Ltd.
Box compounds and Bittite tape.—Callender's Cable and Construction Co., Ltd.
Blackley tape.—Connolly Bros., Ltd.
Pipe compound.—W. H. Mitchell & Co., Ltd.
Wood troughing and covers.—Alex. Bruce & Co.
Tubing and accessories.—Brotherton Tubes & Conduits, Ltd.
Tubing.—Eureka Conduits and Fittings Co.
Dry cells.—A. H. Hunt; General Electric Co., Ltd.
Soldering paste.—W. P. Burnley & Co.
Varnish.—Pinchin, Johnson & Co., Ltd.
Evertite jointing.—R. L. Ross & Co., Ltd.

**Meter Contracts.**—The following contracts have been secured by the Electrical Co., Ltd.:—

Burnley Corporation.—Seventy type St tramcar watt-hour meters, mounted on special spring frame to take up the vibration.
Hammersmith Borough Council.—Hour meters for 12 months.
Falkirk Borough Council.—Polyphase meters, with and without maximum-demand indicators, for 12 months.

**Newport (Mon.).**—The T.C. has accepted the tender of Mr. R. W. Moor for the erection of an extra-high-tension switch house and motor house, at £599; and that of Mr. Bertram Thomas for additional extra-high-tension switchgear, at £168.

**Rotherham.**—Messrs. Chamberlain & Hookham, Ltd., have received the contract for meters of 10 amperes capacity and upwards.

**St. Marychurch.**—For installing the electric light at the Parish Church, the tender of Messrs. Drury & Chaffe has been accepted. The cost will be over £150.

**Sheffield.**—The City Council has accepted the following tenders:—

Vickers, Ltd.—125 tramcar tires.
Brush Electrical Engineering Co., Ltd.—25 double-deck top-covered extended-canopy cars, £640 per car (plus 5 per cent. for contingencies).
Lea Recorder Co., Ltd.—One combined indicating and recording water meter, including steel notch tank and float chamber, £118.
Longbottom & Co.—Annual supply of coal to the generating stations, 9s. 11 per ton.

**Stockport.**—The Tramways Committee has accepted the following:—

Welding Hazel Grove tramway track.—Tudor Accumulator Co., Ltd.
24 semi-elliptic steel springs (eight laps).—Smith Bros. & Hill, 9s. 6d. each.
Three pressed-steel gear cases.—Watlington & Co., £2 17s. 6d. each.
Set of spare wheels for trackless trolley vehicles.—Atlas Resilient Road Wheel Co., Ltd., £20 10s.

The Corporation Electricity Committee has accepted the following tenders:—

15 tons of copper to be made into cable during two years.—W. T. Glover and Co., Ltd.
Circulating pipes for turbo-condenser.—Engineering Supply Co., £65.
Twin strainer for removing foreign matter from water supply.—Royle's (Irlam), £75, less 5 per cent.
Grease-eliminating and water-softening plant.—Messrs. Bell Bros., £260.

**Walsall.**—The following tenders have been accepted by the T.C.:—

Callender's Cable and Construction Co., Ltd.—Laying A.C. mains from Bath Street to Sandwell Street, £179.
H. Gough & Son.—Foundation work for new boiler house and economiser house.
W. S. Laycock, Ltd.—Rollers and blinds for cars now being fitted with vestibules, £72.

**Warrington.**—The offer of the Monovel Governor Co. to install a 12-in. Chorlton Whitehead governor to the 300-KW. Westinghouse turbine, at a cost of £41, has been accepted by the Council, which, however, reserves the right to reject the apparatus during the first month's use.

**Wigan.**—The E.L. Committee has accepted the following tenders for fuel for the electricity works for 12 months:—

Pearson & Knowles.—3,500 tons.
Ackers, Whitley & Co.—1,000 tons.
William Reay & Co.—1,000 tons.
Wigan Coal and Iron Co.—4,000 tons.
F. E. Moss.—2,000 tons.
Worsley Mesnes Colliery Co.—500 tons.

## NOTES.

**Foreign Trade in July.**—The official trade returns for last month show advances of 5·9 per cent. in imports, 12·3 per cent. in exports, and 17·7 per cent. in re-exports, as compared with the corresponding month of 1912, the increases being £3,487,253, £5,177,848, and £1,217,674 respectively. In the exports section the higher prices of coal and cotton are responsible for a large proportion of the advance. The following figures relate to the electrical and machinery trade :—

IMPORTS.

| | *Month of July.* | *Increase or decrease.* | *Seven months, 1913.* | *Increase or decrease.* |
|---|---|---|---|---|
| Electrical goods and apparatus, excluding machinery and insulated wire ... | £122,688 | + 26,029 | £868,817 | + £50,337 |
| Machinery ... | £633,944 | + 80,133 | £4,391,682 | + £410,496 |

EXPORTS.

| | | | | |
|---|---|---|---|---|
| Electrical goods and apparatus, excluding machinery and insulated wire ... | £509,083 | +215,670 | £3,191,894 | + £832,148 |
| Machinery ... | £3,131,686 | +373,181 | £21,556,229 | +£3,108,538 |

**Municipal Wages at Nelson.**—Nelson Electricity Committee have considered applications from the Municipal Employés' Association respecting several classes of men. It was resolved (1) that the commencing wages of firemen be increased from 25*s.* to 27*s.* per week ; (2) that the minimum and maximum wages of charge engineers be increased from 28*s.* to 30*s.* and 35*s.* to 37*s.* 6*d.* per week respectively. It was resolved that 10 minutes per shift be allowed to drivers and conductors for coming on and going off duty.

**A Model Gas-Engine Plant in Japan.**—In the article on the above which appeared on p. 141, the Power Gas Corporation, Ltd., point out that fig. 1 shows diagrammatically an atmospherically-cooled plant, whereas the Kawasaki producer plant, which is described (and illustrated in fig. 2) is of the Mond pressure type, and utilises water cooling—a point which was plainly stated in the article.

**The Private Installation.**—The last sentence in the first paragraph of the above article on page 207 of our last issue was incomplete, the following words being accidentally omitted after the word "premises"—"may want to supply his neighbour. Can he do so ?"

**Engineers and National Agreement.**—The *Times* states that the working agreement between employers and workers in the engineering industry throughout the United Kingdom is threatened as the result of a decision by the Executive Council of the Amalgamated Society of Engineers. A circular was issued to the branches on 11th inst., asking the men to vote for and against ending the agreement, and also for and against continuing the premium bonus system. "It is regarded as a foregone conclusion that the ballot will go against both the agreement and the premium bonus system, and in that case the executive say they will serve the necessary three months' notice on the employers without delay."

**Parliamentary.**—VARIOUS BILLS.—In the House of Lords on August 6th the Metropolitan Electric Tramways (Railless Traction) Bill passed its third reading, and in the House of Commons, on Tuesday, the City and South London Railway Bill was read a third time.

**Calcium Cyanamide Statistics.**—While the world's production of cyanamide of calcium in 1910 totalled 110,000 tons, and in 1912 153,000 tons, on June 1st of the current year it had risen to 260,000 tons. The increase is due principally to two new producers in Sweden (12,000 and 15,000 tons) ; and one American (24,000 tons) ; also to increased outputs from existing German (30,000 tons), Norwegian (28,000 tons), and Swiss works (4,000 tons).—*Chemiker Zeitung.*

**Fatalities.**—An inquest was held last week into the death of a child aged five years, who was found dead across the live rail of the North-Eastern Railway at Percy Main. The father complained that the line was not properly fenced, but it was stated that the child would have to climb two walls in order to get on to the line.

At an inquest held into the death of Tom Roxborough (34), steam motor-lorry driver, in the employ of Messrs. W. & R. K. Lee, doublers and spinners, Sowerby Bridge (see ELECTRICAL REVIEW, August 1st, page 186), the jury brought in a verdict of "Accidental death caused by electric shock." Roxborough was engaged repairing a steam motor-lorry, and he was found on his knees on the footplate between the boiler and the coal bunker, with his head thrown backwards and his hands hanging down. He was groaning, and behind his ears and neck the skin was blue. An electric lamp wire was resting on his left shoulder. The foreman mechanic, in giving evidence, said that he resorted to artificial respiration for a quarter of an hour, when two doctors arrived on the scene. Afterwards he found the electric lamp produced, detached from the broken wire, on the lorry. The conclusion he came to was that by treading on a wire he pulled it out of the lamp, and the live wire then touched his sleeve or his arm, and he received an electric shock. Deceased had been shovelling small coal dust from underneath the footplate, the board covering which having been removed immediately before the accident happened. From what witness had heard, deceased had asked for the lamp he was using, and it had been lent to him. The wire was insulated, and the voltage was 230.

On Wednesday an inquest was held at Manchester into the death of Henry Hill (25), Peacock Street, Gorton, an electric wireman employed by Messrs. Beyer, Peacock & Co., Gorton. The evidence was to the effect that on Monday the deceased was working on a ladder, which was propped against a beam carrying live cables. He was seen to fall, and his head struck an iron block at the foot of the ladder. He died in the infirmary, and his left hand was burnt in such a way as to suggest that he had had an electric shock. A foreman in the electricity department of the works said the cables were about 8 in. above Hill's head as he was at work on the ladder, and he would have no need to touch them. Even if he had touched them, witness did not think he would have received a shock, as the cables were thickly coated with oxide. Witness had tried the cables and had not received a shock. Dr. Buck, of the Infirmary, said the cause of death was a fracture of the skull. The left hand was shrivelled as though a strong electric shock had been received. He knew of nothing which would cause such an injury, except a shock. The Coroner said he did not see how they could get away from the fact that Hill touched the cable and received a shock. It might be another case of familiarity breeding contempt. There was nothing to suggest that there was any fault to be found with the installation. A verdict of "Accidental Death" was returned.

The *Times* states that Indian papers just received report the death of Mr. A. Kinghorn, manager of the Burma Development Syndicate, Ltd. "On receiving information that the main transmission wire had broken between Victoria Point and Maliwun he went to the spot with his electrician and a coolie. Finding a wire lying across the path Mr. Kinghorn pushed it to one side with his umbrella and kicked it with his wet boots. Death was instantaneous."

**How Germany Secures Trade.**—In connection with the pending renewal of the Treaty of Commerce between Russia and Germany, the German Minister of Commerce has circularised a number of Chambers of Commerce with the inquiry as to how Germany has won its present prominent position in the Russian market. One Chamber only—that of Moscow—has made reply as follows :—"During the last 10 years the number of German commercial travellers in ironware and kindred products has remarkably increased, and more especially in the branches of machinery, electrical material and patented articles. The German traveller possesses a fundamental knowledge of the goods which he offers ; he knows every detail of its production, and to which qualities he must draw attention, and those which most interest the purchaser. He is always well informed as to the current prices and the stocks at the moment on the market. . . . To increase sales, German firms make liberal and frequent dispatches of samples gratis, and beg the receiver to give the goods a trial and make report. Then follows a traveller. German firms are prompt in the execution of orders, and take the greatest care with the details of packing. Many German firms have appointed agents in Russia, or opened branch houses, in order to get into closer touch with the market. . . ." This laudatory epistle, which seems to show that German firms and their representatives come very near perfection in their business arrangements, explains the preponderating position which the German Empire now occupies in Russian trade ; it also implies that other competitors in the Russian market, including ourselves, are more or less deficient in those qualities which have conduced to the German success.

**Determining the True Temperature of Incandescent Lamp Filaments.**—The great differences in the energy consumption of different types of lamp have been partly accounted for by the influence of increased temperatures or differences in selectivity. Coblentz has even established some laws supposed to govern the selective emission of tantalum, osmium and tungsten, which, however, eventually proved incorrect.

In a paper read at a recent meeting of the German Society of Illuminating Engineers, Dr. Lummer discussed the question how the true temperature of the luminous substances used in our sources of light could be ascertained. What temperature will be assumed by a body into which a given number of joules is thrown ? The energy absorbed is given out by conduction and radiation. If conduction be eliminated, only the laws of radiation ought to be known. For one kind of body, viz., for what is called the black body, the law of radiation is actually known, the whole energy of radiation being proportional to the fourth power of absolute temperature. The number of joules being known and the surface being calculated from the thickness and length of the body, there only remains a constant to be determined for each substance in order to have all the data for calculating the temperature. It is true that the laws of black radiation do not apply to carbon. For one substance, viz., platinum, the law of radiation is known, the Joule heat being equal to a constant multiplied by the surface and the fifth power of temperature, which allows the temperature of platinum filament-lamps to be calculated. On the other hand, the same temperatures can be ascertained by actual observation from the radiation of platinum. In fact Kurlbaum's electrically-heated platinum box allows these temperatures to be measured most accurately. If the same platinum box be coated with the metal of each lamp to be examined, the filament temperatures of all substances used in actual practice could be ascertained. Experiments of this kind would allow the causes of existing differences in the efficiency of lamps to be ascertained.

**Strike.**—A strike of moulders is in progress at Sheffield. Masters and men were to meet on Wednesday. The former had issued summonses against the strikers for leaving work without giving notice. The men would not resume work until these summonses were withdrawn, and to this demand the employers declined to accede.

**Accident.**—An accident occurred in part of the conduit warehouse of Messrs. Accles & Pollock, Ltd., at their works at Oldbury. Shortly after work was resumed after the holidays on Thursday, last week, while stocktaking was proceeding, the racks suddenly gave way, with the result that two of the men were imprisoned beneath a mass of 70 tons of tubes. For a couple of hours every available employé worked with a will until the men were released little the worse for their experience. Their miraculous escape was due to the tubes having formed an arch over them. Naturally, the greatest care had to be taken in removing the tubes.

**Annual Outings.**—On Saturday, August 2nd, over 300 of Messrs. A. Reyrolle & Co.'s employés travelled by special train to Edinburgh, where a most enjoyable day was spent in general sight seeing, the section of the National Museum allotted to working models proving an irresistible attraction to many members. Tea was served at the Edinburgh Café Co.'s premises, where speeches were made by various members of the staff, in which the rapid expansion of the firm was the main theme.

The staff of the Faraday Electrical Co., Ltd., of Wandsworth, went for their annual outing on Saturday, August 9th. The company journeyed by train to Eastbourne, and after a morning ramble to Beachy Head and Lighthouse, dinner was served at Randolph House, on the Royal Parade. The weather was favourable, and a good time was spent.

**Inquiry.**—Makers of the "Gibbs" electric fan are asked for.

**Association of Electrical (Station) Engineers.**—A general meeting was held last week at the Y.M.C.A., Newcastle-on-Tyne (Mr. J. W. Lanham, chairman). The general policy of the Association was well discussed, severe criticism being passed upon the "wait and see" community in this district, who it was stated would join the Association after all the uphill work had been done. It was proposed to hold a social and musical evening during the coming month, particulars of which will be duly announced. During last month meetings have been held at Grimsby and Manchester to receive the delegate's report of the conference. Mr. P. B. Roberts, of the Grimsby Branch, has promised to read a paper at the next meeting, September 11th, entitled "Running a Steam Turbine."

The information bureau of the Association, though not yet in proper working order, has been able to warn members off a number of stations where conditions were very bad, and in a few cases the undertakings concerned have had to increase the salaries offered for vacant positions, and shorten the number of working hours, before they could obtain men. Successful efforts have also been made to find better paid positions for a number of "15s. and 20s., shift engineers," and, in some cases, with over 100 per cent. increase in salary, and some of the undertakings which are notoriously "bad payers" have lately slightly increased the salaries offered (as per recent advertisements), owing to the difficulty in obtaining and retaining engineers to run their stations.

Continued efforts are to be made on these lines, and it is hoped to obtain the co-operation of those engineers who are at present in receipt of fair salaries, and to whom it must be pointed out that before they can improve their own conditions they must organise themselves, and in the first place raise the status of the profession generally by assisting their underpaid colleagues throughout the country to better conditions. Without this effort the status must decline and with it of course the salaries paid.

**The Electrical Plant at the Cockerill Steel Works at Seraing, Belgium.**—In connection with the forthcoming meeting of the British Iron and Steel Institute in Belgium, when visits to a number of the leading iron and steel works in the country will be included in the programme, the following particulars and the electrical plant at the well-known iron and steel works of the Cockerill Co., at Seraing, near Liége, will be of interest.

The company was among the first to take up the question of the utilisation of the waste gases from blast furnaces and coke ovens, and the designing of special internal combustion engines to work with the same, and the fact that the electricity-generating plant at the Seraing works has now a capacity of no less than 12,300 H.P., all the engines utilising these waste gases, gives an excellent idea of the progress that has been made.

Current is generated by two distinct plants; the first, which, working with blast furnace gas, dates from 1901; it has a capacity of 7,500 KW., and comprises two engines of 900 H.P. and six of 1,400 H.P. The second station, where coke oven gas is utilised, is equipped with two 550-H.P. engines and one of 1,000 H.P., the capacity being 1,600 KW. Continuous current is generated; the two stations are about three-quarter mile from each other and work in parallel.

Current is supplied to 950 electric motors for power purposes, and to 8,000 incandescent and 1,500 arc lamps, the annual output of the two stations being about 35,000,000 KW.-hours. The distribution for the motors is at 250 volts pressure, and for lighting at 125 volts. A 500-KW. motor-generator is also provided for converting the continuous current to alternating at 2,000 volts for use at the mines, and two three-phase sets for operating crushing mills at the cement works.

The mains are of the overhead type, a separate network being provided for each section of the works. The company states that by utilising the waste gases the cost of the current is very low, and much lower than is possible even with the most modern steam-operated plant.

Each year witnesses a further development in the utilisation of electrical energy at the Cockerill Works. All the travelling and fixed cranes—110 in number—are now fitted with electric motors, most of the shafting is now electrically-driven, as also is the majority of the pumps, crushing mills, ventilation and rolling mill plants.

**International Engineering Congress, 1915.**—The Committee of Management of the International Engineering Congress, 1915, asks us to announce that Col. Geo. W. Goethals, chairman of the Isthmian Canal Commission and chief engineer of the Panama Canal, has consented to accept the honorary presidency of the Congress, and will preside in person over the general sessions to be held in San Francisco, September 20th-25th, 1915.

**Educational Notes.**—The South-Western Polytechnic Institute, Manresa Road, Chelsea, will re-open on September 29th for day classes and on September 22nd for evening classes. The engineering courses include lectures in electrical and mechanical engineering, physics, chemistry and mathematics and practical instruction in the fully-equipped laboratories of the institute. The laboratories and workshops of the institute may be inspected by intending students. In the electrical wiring department a new advanced course will be commenced this session suitable for preparation of candidates for the final wiremen's examination of the City and Guilds of London Institute. Arrangements have been made for placing students who have passed satisfactorily through the three years' day course in positions with large engineering firms, and hitherto such firms have offered more vacancies than the institute has been able to fill with its students. The prospectus may be obtained from the Secretary, price 1d., or by post 3½d.

The new course at the Crystal Palace School of Practical Engineering will commence on September 10th as announced in our advt. pages to-day.

University of London, University College, Gower Street, W.C.—We have received a copy of the Hand-book of the Faculty of Engineering at this College for the forthcoming session, which commences on September 30th. It contains particulars of entrance scholarships and exhibitions, and information respecting the mechanical, electrical, civil and municipal courses.

**Legal.**—British Vacuum Cleaner Co., Ltd., *v.* Jas. Robertshaw & Sons, Ltd.—Application was made to Mr. Justice Astbury, sitting as Vacation Judge, by the defendants in their patent action for a stay of execution. It was explained that the Sheriff was in possession for the costs, though the inquiry as to damages and delivery up of the alleged infringing articles had been stayed pending an appeal. His Lordship felt a difficulty in dealing with the matter, as he had advised on the case while at the Bar. After some discussion it was arranged that the application should be dealt with by the succeeding Vacation Judge in September, and in the meantime the Sheriff should be withdrawn, the defendants paying his costs and paying the amount of the debt into Court.

**National Physical Laboratory.**—A daily paper states that on account of the buildings recently erected, the assessment of the National Physical Laboratory at Teddington has been increased from £1,000 to £1,960.

**The Lighting of Foundries.**—In the course of a special report on the "Artificial Lighting of Iron Foundries," by D. R. Wilson, included in the Report of the Inspector and Factories and Workshops, it is stated that in connection with the inquiry, 40 iron foundries in different parts of the kingdom were visited in order to ascertain the efficiency of the artificial illumination. For efficient lighting the illumination in iron foundries should be high compared with other rooms.

It would appear that the most satisfactory method of lighting is by means of powerful units, fixed as high as possible above the floor and spaced comparatively close together. This method is adopted in most of the foundries classified as well lighted.

All the observations have reference to a horizontal plane 1 ft. above the floor level, and were made by means of a holophane lumeter with a range of 0·01 to 1,000 ft.-candles. The results of observation show that a sharp distinction may be drawn between well and badly lighted foundries. In some of the former the very high minimum value of 1·5 ft.-candles is attained and even exceeded, and the lighting may be considered good if the illumination does not fall below 0·5 ft.-candle. In the badly lighted foundries in almost all instances the system of lighting consists of ordinary flat-flame gas burners. The actual data indicate the extremely bad lighting that exists in some of these foundries, measurements as low as one-sixtieth of a ft.-candle being recorded, the lighting cannot be deemed to be adequate unless the illumination received on a horizontal plane 1 ft. above the floor level is not less than one-third of a ft.-candle over any part in which work is being carried on or over which any person is liable to pass.

Two tables accompanying the report, giving particulars of the illumination of well-lighted and badly-lighted foundries respectively. In the former, out of 24 examples, ten are classed as "excellent"; these are all lighted with flame arcs, inverted arcs, or ordinary arc lamps, sometimes supplemented with metallic-

filament lamps. In one very large foundry (126,600 sq. ft.) there are 91 flame arcs in seven rows, 17-22 ft. high and 43 ft. apart, with 64½ ft. between rows. The illumination ranges from 2·8 to 1·8 ft.-candles, and is described as very uniform. Another (51,200 sq. ft.) is lighted with 32 arcs 40 ft. apart, in four rows 40 ft. apart, at a height of 14 ft. The illumination varies from 3·9 to 1·5 ft.-candles, and is classed as "uniform and very good." Very often, however, a single row of arcs down the centre, from 12 to 30 ft. high, and from 22 to 30 ft. apart, give excellent results. In five foundries the illumination with arc lamps is described as good. Metallic-filament lamps are used alone in three cases, one of which is "good" (1·8 to 0·88 ft.-candles) and two "fair" (3·2-0·4 and 2·2-0·38 ft.-candles). One foundry lighted with inverted gas mantles is described as "very good" (1·8 to 0·7 ft.-candles), another as "fair" (1·8-0·35 ft.-candles), and a third with high-pressure gas is "good" (1·4 to 0·88 ft.-candles).

All the "badly-lighted" foundries were equipped with gas-jets except two, in which incandescent gas was used. The maximum illumination observed in any of them was 1 ft.-candle.

**Some New Forms of Recording Instruments.**—The word "radical" at the top of the second column, page 246, should read "radial"; also the "resonance," second paragraph, page 247, should read "remanence."

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.*

**Central Station Officials.**—The South Shields T.C. has increased the salary of MR. H. F. ELLIS, electrical engineer, from £400 to £450 per annum.

The staff and employés of the Stratford-on-Avon Electricity Co. have presented a silver cigarette case to MR. J. E. WOODS, who is leaving to take up a position at Nuneaton in the engineering department of the G.P.O.

The Bury T.C. has increased the salary of MR. J. G. POTTS, works superintendent at the Chamber Hall power station, from £156 to £170, with a further increase to £180 in a year hence.

MR. W. J. FERGUSON, on retiring from the position of works manager of the Redditch electricity undertaking, was presented by the officials of the Council with a gold lever watch. Mr. Ferguson had been at Redditch 14 years. The staff and employés presented him with a pair of bronze figures, and Councillor Dolphin gave a pocket wallet.

**Tramway Officials.**—MR. JAMES DALRYMPLE, general manager of the Glasgow T.C.'s tramways, and MR. THOMAS NISBET, master of works, left Glasgow on Saturday on board the *Cameronia* for the United States, in order to inspect cross-river bridges with particular reference to tramways work. Within the next week or two, Bailie W. B. Smith, convener of the Electricity Committee, and Mr. W. W. Lackie, the chief electrical engineer, will depart for the States and Canada, as already reported, to inspect the largest electrical installations there in connection with the erection of a new power station in the Dalmarnock district of Glasgow.

**General.**—The *Times*, in alluding to the strong feeling that exists among many scientific men that an effort should be made to secure that the invaluable work of the late Prof. Milne, the seismologist, should be continued, quotes an eminent scientific authority to the effect that the late Prof. Milne used to spend £400 or £500 a year out of his own pocket in keeping up his scientific enterprise. There was a small grant of less than £100 a year from the British Association, and the matter will be discussed at next month's meeting of that Association. Everything, however, depends upon finding generous contributors to provide a fund for endowment. "Mr. Matthew H. Gray, F.G.S., F.R.G.S., a close friend of Prof. Milne, has set a noble example by giving some time ago £1,000 towards this object, and this is known as the Gray Fund, Prof. Milne having refused to receive it for himself."

MR. J. H. HOWE, secretary to Messrs. Richardsons, Westgarth and Co., Ltd., of Middlesbrough, who is leaving to take up an appointment at Belfast, has been presented by the staff with a gold albert with medallion, and a gold bracelet for Mrs. Howe.

The *Indian Textile Journal* states that MR. CARDEW, electrical inspector to the Madras Government, has been appointed chief electrical engineer to the North-Western Railway, Lahore.

We regret to read in the *Times* that SIR WILLIAM PREECE is lying ill at his residence at Carnarvon. "Sir William, who is 79 years of age, has been confined to his room for a fortnight, and his friends are afraid that it will be impossible for him to be moved to a warmer climate." He has been suffering from a severe attack of bronchitis. We desire to tender our deep sympathy with Sir William in his illness, and to express a hope that he will soon improve in health.

MR. C. H. AVERY, B.Sc., of University College, London, and MR. F. A. EUSTACE, of the City and Guilds Technical College, Finsbury, have been appointed to the Heating and Ventilating Scholarships awarded by the Institution of Heating and Ventilating Engineers, tenable at University College.

At St. Matthew's, Chapel Allerton, Leeds, on August 9th, MR. ARTHUR W. FITHIAN, M.I.E.E., only son of Sir Edward W. Fithian, J.P., of London, was married to Mary Teresa, only daughter of the late George Jaques, of Leeds.

The Malvern U.D.C. has received with regret the resignation of MR. W. J. RENDELL BAKER, gas and electricity engineer, who has been appointed gas and water engineer by the Mansfield T.C. A successor at a salary of £350, rising to £400, was advertised for last week.

**Obituary.**—MR. FREDERICK BROWN.—We learn with deep regret of the death of Mr. Frederick Brown, of Walsall, at the age of 65 years, after an illness extending over nine months. Mr. Brown was manager of the Wednesbury and Wolverhampton district of the National Telephone Co. until 1884, when he turned his attention to the establishment of the Walsall Electrical Co. In July, 1892, the business was converted into a limited liability company, with the deceased gentleman as managing director. The *Walsall Observer* remarks that it was largely owing to Mr. Brown's undoubted business acumen, tempered with a strong sense of justice and a generous nature, that the firm has made such satisfactory progress. As consulting electrical engineer to the Walsall Corporation many years ago, Mr. Brown reported on electric traction systems in the United States, and it was upon his advice that the overhead trolley system now in use was adopted. For very many years he took a leading part in the affairs of the local Chamber of Commerce.

## NEW COMPANIES REGISTERED.

**Western Engineering Co., Ltd.** (130,527).—This company was registered on August 6th, with a capital of £2,000 in £1 shares, to take over the business of an electrical and general engineer carried on by C. E. Isaac, at 24, Frogmore Street, Bristol, as the Central Engineering Co. The subscribers (with one share each) are:—Mrs. M. R. Isaac, 10, West Shrubbery, Bristol; C. W. Isaac, 24, Frogmore Street, Bristol. Private company. The number of directors is not to be more than three; C. W. Isaac is first permanent director; qualification, £50; remuneration as fixed by the company. Registered office, 24, Frogmore Street, Bristol.

**Mossay & Co., Ltd.** (130,519).—This company was registered on August 6th, with a capital of £2,000 in £1 shares, to carry on the business of railway, motor, mechanical, electrical and general consulting engineers and manufacturers, founders, tool-makers, car, coach, carriage and van builders, woodworkers, manufacturers of and dealers in machinery, vehicles, boats, diving and flying machines, &c., and to enter into a contract with P. A. Mossay. The subscribers (with one share each) are:—P. A. Mossay, 4, Abbots Road, Hampstead, N.W., civil and consulting engineer; A. J. Makower, 37, Maresfield Gardens, Hampstead, N.W., electrical engineer. Private company. P. A. Mossay is first managing director, with power to appoint others; qualification, £250 shares. Registered office, 45, Horseferry Road, Westminster.

**J. T. Pickering Hoist and Engineering Co., Ltd.** (130,544).—This company was registered on August 7th, with a capital of £1,000 in £1 shares, to carry on the business of general mechanical engineers, manufacturers of hoists and lifts, motors, and electrical and other appliances, &c., and to adopt an agreement with J. T. Pickering. The subscribers (with one share each) are:—J. T. Pickering, 41, Evington Road, Leicester, engineer; J. B. Smith, 308, Aylestone Road, Leicester. Private company. The number of directors is not to be less than two or more than three; the first are J. T. Pickering and J. B. Smith; qualification, £1; remuneration as fixed by the company. Registered by J. T. Pickering, 41, Evington Road, Leicester.

**W. Parsons & Co., Ltd.** (130,508).—This company was registered on August 5th, with a capital of £2,000 in £1 shares, to take over the business of an electrical, mechanical and general engineer and contractor, by W. Parsons at Regent Street, Leamington, Warwick, as "Parsons & Co." The subscribers (with one share each) are:—W. Parsons, Regent Street, Leamington, electrical engineer; G. Williams, 156, Edmund Street, Birmingham, solicitor. Private company. The number of directors is not to be more than five; W. Parsons is sole director. Solicitor, G. Williams, Bank Buildings, Cradley Heath. Registered office, Regent Street, Leamington, Warwick.

**Edison Accumulators, Ltd.** (130,495).—This company was registered on August 5th, with a capital of £150,000 in 135,000 7 per cent. participating preference shares of £1 each, and 300,000 ordinary shares of 1s. each. Objects: To carry on the business of manufacturers of, and dealers in, electric storage batteries of all kinds, and apparatus and things used in connection with the generation, distribution, supply, accumulation and employment of electricity, electrical and general engineers, proprietors of motors, carriages, omnibuses and other conveyances, motor garage proprietors, marine engineers, &c., and to adopt an agreement with J. F. Monnot. The signatories (with one preference share each) are:—A. E. Lambert, 33, Loxley Road, Wandsworth Common, S.W., solicitor; J. M. Burchell, 56, Hurlingham Court, Fulham, S.W., solicitor; C. Vince, Croydon, Elm Park Gardens, Barnes, S.W., clerk; W. A. French, 171, Carlingford Road, West Green, Tottenham, N., cashier; C. Hendy, 5, Marney Road, Clapham Common, S.W., clerk; C. Giggs, 65, Arlingford Road, Tulse Hill, S.W., clerk; J. A. Braik, 20, Cambridge Road, Wimbledon, S.W., accountant. Minimum cash subscription, £25,000. The first directors (to number not less than three or more than eight) are Lord Montague of Beaulieu, 62, Pall Mall, S.W., Col. H. C. L. Holden, C.B., F.R.S., M.I.E.E., Gifford House, Blackheath, A. L. Pearse, Worcester House, Walbrook, E.C., and J. F. Monnott, 49, Old Broad Street, E.C.; qualification (except first directors), £250; remuneration (except managing director), £300 per annum (chairman, £300). Registered office, 49, Old Bond Street, W.

**Opel Motors, Ltd.** (130,548).—This company was registered on August 7th, with a capital of £15,000 in £1 shares, to acquire the business carried on by the British Electromobile Co., Ltd., at 5 and 6, Halkin Street, Hyde Park Corner, and elsewhere, to carry on the business of agents for the sale, hire or exchange of Opel and other motor-cars and vehicles (complete with body or chassis only) and accessories, body and frame builders, tire manufacturers and dealers, suppliers of electricity, petrol or other power, &c., to adopt agreement with the said company and R. B. Tyler, C. F. G. R. Schwerdt and D. Watson, and to acquire the benefit of an agency agreement between Adam Opel and the said C. F. G. R. Schwerdt and D. Watson. The subscribers (with one share each) are:—F. R. While, 18, Holmewood Road, South Norwood, S.E., clerk; J. T. R. H. Dormer, Oak Farm, Billericay, Essex, clerk. Private company. The number of directors is not to be less than two or more than five; the first are C. F. G. R. Schwerdt, D. Watson and A. W. S. Pocklington; remuneration as fixed by the company. Registered office, 1, Queen Victoria Street, E.C.

**Tempo Electric Supply Co., Ltd.** (4,018).—This company was registered in Dublin on August 1st, with a capital of £500 in £1 shares, to carry on the business of electricians, engineers, dealers in electricity, motive power and light, &c. The subscribers (with five shares each) are:—Rev. J. Wilson, The Rectory, Tempo, Co. Fermanagh; Rev. P. S. O'Neill, Tempo; C. Brady, Tempo, national teacher; S. R. Gibson, J.P., Tempo; J. McKigney, Tempo, farmer; B. Breen, Tempo, merchant; P. Maguire, Tempo, merchant; E. McCaffrey, J.P., Tempo; E. Rogers, Tempo, national teacher; Rev. J. Wilson, Tempo. Private company. The number of directors is not to be les

than three or more than 10; the first are the Rev. J. Wilson, Rev. P. S. O'Neill, C. Brady, S. R. Gibson, J. McKigney, P. Maguire, B. Breen, E. McCaffrey, J.P., E. Rodgers and Rev. J. Wilson (hon. secretary). Registered office, Tempo, Co. Fermanagh.

**Leyburn Electric Supply Co., Ltd.** (130,488).—This company was registered on August 2nd, with a capital of £1,200 in £1 shares, to carry on the business of an electric light company at Leyburn, Yorks., and elsewhere. The subscribers (with one share each) are:—F. Wilson, Leyburn, draper; P. Dobson, Leyburn, postmaster; J. Watmough, Leyburn, farmer; R. May, Leyburn, plumber; C. W. Sanderson, Leyburn, joiner; C. W. Plews, Leyburn, printer; Mrs. K. Dobson, P.O., Leyburn. Minimum cash subscription, £700. The number of directors is not to be less than four or more than six; the first are F. Wilson, P. Dobson, J. Watmough and R. May; qualification, £50. Solicitors, Chapman & Wilkinson, Leyburn, Yorks. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**British Westinghouse Electric and Manufacturing Co., Ltd.** (62,414).—Return dated May 19th, 1913. Capital, £1,875,000 in 500,000 pref. shares of £3 each, and 75,000 ord. shares of £5 each. All shares taken up. £1,500,000 paid on the pref. £375,000 considered as paid on the ord. Mortgages and charges: £1,462,553.

**British Thomson-Houston Co., Ltd.** (47,982).—Return dated July 11th, 1913. Capital, £800,000 in £10 shares (40,000 ord. and 40,000 pref.). All shares taken up. £10 per share called up on 32,531 ord. and 40,000 pref. £725,310 paid. £74,690 considered as paid on 7,469 ord. shares. Mortgages and charges: £245,715.

**Hewson Manufacturing Co., Ltd.**—Particulars of £1,000 debentures, created April 14th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Electrical Power Storage Co., Ltd.**—Issue on July 30th, 1913, of £5,000 debentures, part of a series of which particulars have already been filed.

**Renton, Holdsworth & Co., Ltd.** (102,086).—Return dated June 17th, 1913. Capital, £10,000 in £1 shares: 6,552 shares taken up; £1 called up on 6,052; £6,052 paid; £600 considered as paid on remainder. Mortgages and charges: Nil.

**Perth Electric Tramways, Ltd.**—A memorandum of satisfaction in full of debenture stock and debentures issued under trust deeds dated August 19th, 1901, and December 30th, 1903, securing £100,000 has been filed.

## CITY NOTES.

### Tyneside Tramways and Tramroads Co.

In their half-yearly report the directors state that the surplus of receipts over expenditure is £5,446, plus £427, making a total to the credit of profit and loss account of £5,873, and after deducting interest on debentures, loans, &c., amounting to £1,009, there remains an available balance of £4,864. The directors propose to pay a dividend on the preference shares at the rate of 5 per cent. per annum (less income-tax), £601; a dividend on the ordinary shares at the rate of 3 per cent. per annum (less income-tax), £2,008; putting to the credit of reserve for renewals, depreciation and other contingencies, £1,200, which is now £14,538; setting aside for the reduction of registration and formation expenses, &c., £330, leaving to be carried forward £724.

The half-yearly meeting was held at Newcastle-on-Tyne on 11th inst., Dr. J. T. Merz (chairman) presiding.

The Chairman, in proposing the adoption of the above report, said the accounts did not show much difference compared with last year. There was, nevertheless, an appreciable increase in the revenue, and, as a consequence, in the dividend proposed. The revenue was £1,049 more than the corresponding half of last year, which was a record. The increase on the ordinary traffic was £579, on workmen's traffic £59, and on holiday traffic £411. It was especially satisfactory to note that the ordinary traffic was gradually increasing, for this furnished the most important part of the company's income. The holiday and workmen's traffic was always subject to such contingencies as the weather and the state of trade in the district. The number of passengers had increased by 214,503, which was not quite so large an increase as was reported a year ago—240,000. The revenue per car-mile had been 9·498d.; a satisfactory figure. Last year it was 9·28d., in 1911 it was 8·8d., and a year before that it was 8·2d. Meanwhile, the expenses per car-mile were 6·27d., compared with 6·01d. in the corresponding half of last year, the increase being due, to a large extent, to the expenses for maintenance, which were now defrayed entirely out of revenue. If maintenance became more expensive they would, of course, have to draw upon the reserve fund, which was created for that purpose. The increase of available profit for the half-year it was proposed to deal with by paying a dividend at the rate of ½ per cent. more, absorbing £335; by putting to the reserve fund £1,200 instead of £1,000, as was the case last year, and by increasing the investments in Consols £87. They had reduced their loans by £160. Their reserve now stood at £14,538, as against £11,750 a year ago. He was pleased to state that there was a slow but steady improvement in the affairs of the company. The directors might have proposed to pay a larger dividend, but their policy had always been first to strengthen the reserve fund, and, secondly, to give only such an increase as they could reasonably expect to maintain. They hoped in the next half-year to be in a position to increase the dividend in a similar manner.

Mr. G. E. Henderson seconded the report, which was carried unanimously.

**Fairbairn, Lawson, Combe, Barbour, Ltd.**—The directors have declared an interim dividend on the preference and ordinary shares at the rate of 5 per cent. per annum for the half-year ended June 30th.

**Japan.**—The *Indian Textile Journal* for July quotes the *Osaka Ashai* as follows:—

"The profits of the electric tramways in the neighbourhood of Osaka, Japan, for the half-year ending March 31st—with the exception of the Keihan Electric Tramway—have shown a heavy decrease as compared with the figures for the preceding period. The various companies are experiencing great difficulty in arranging their rates of dividend for the period just closed; but, owing to various circumstances, some cannot reduce their dividends, and these have determined to pay the same dividend as hitherto declared. It is said that 13 per cent. for the Hanshin, 9 per cent. for the Nankai, and 7 per cent. for the Mino-Arima are foregone conclusions, while 6 per cent. for the Hankai and 5 per cent. for the Koya Tozan and the Osaka Tramway are almost equally certain. The directors of the Keihan are inclined to recommend a dividend of 6½ per cent., but the large shareholders are demanding an increase to 7 per cent. The Kyoto Electric Tramways has suffered the heaviest decrease of profit, and opinion is divided among the directors as to whether 3 or 4 per cent. should be declared."

**South Metropolitan Electric Light and Power Co., Ltd.**—The transfer books, &c., will be closed from August 18th to 30th (both days inclusive), for preparation of warrants for interim dividends payable 31st inst.

**Waste Heat and Gas Electrical Generating Stations, Ltd.**—The directors have declared an interim dividend at the rate of 5 per cent. per annum on the issued share capital in respect of the half-year ending July 31st, payable, less income-tax, on August 31st.

**Harper Electric Piano (1910) Co., Ltd.**—The directors have declared a dividend at the rate of 2½ per cent. on the participating ordinary shares for the half-year ended June 1st, making 3½ per cent. for the year.

**Reduction of Capital.**—Otis Elevator Co., Ltd.—A petition for reducing the capital from £200,000 to £68,190 is now pending. The list of creditors is to be made out as from September 13th.

**Continental.**—Belgium.—La Société d'Installations et d'Exploitations Electriques is the name of a new company which has just been formed in Brussels (46, Rue de l'Association) with a capital of £1,200.

Germany.—The Körting Electricitätswerke Gesellschaft, of Berlin, reports a net profit of £15,522 for the last financial year, as compared with £15,517 in the preceding twelve months. A dividend of 8 per cent. is being maintained.

**Hadfield's Steel Foundry Co., Ltd.**—The directors have declared an interim dividend of 5 per cent. (1s. per share), free of income-tax, on the ordinary shares for the half-year to December 31st.

**Oxford Electric Co., Ltd.**—The directors have declared an interim dividend at the rate of 6 per cent. per annum on the ordinary shares for the half-year ended June 30th.

**John Spencer & Sons, Ltd.**—The directors recommend a dividend on the ordinary shares of 3½ per cent., making, with 2½ per cent. already paid, 6 per cent. for the year ended June 30th.

## STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets as a whole show a good deal of strength. There is not a lot of business going on; but, notwithstanding this, the various markets are well maintained, and the reluctant peace to which Bulgaria has been forced is accepted as likely to last—at all events for some time. The countries which have been engaged in the Balkans trouble require time during which to put their finances in order; and it is hoped that for some months at least peace may be preserved.

The Home Railway market continues to improve. Big rises in many stocks took place to-day (Tuesday). The Undergrounds have shaken off much of their recent weakness, and Metropolitan Consolidated in particular has shown considerable strength. The price rose 3¼ to 48¼. Districts are 2 higher. Central London is hardened as regards the assented stocks. Underground Electric Railways further advanced, upon expectations of the current year providing a possible dividend on the ordinary shares, and possibly the "A" shares as well. Those £10 paid, after their rise of 7s. 6d. last week, have gained a further half-a-crown, and the 1s. shares at 11s. 3d. are better. A spurt of 3 points raised the Income bonds to 94½.

London United Tramways Debenture maintained its substantial recovery, but the London and Suburban issues remained weak, and British Electric Traction 6 per cent. Preferred stock is ¼ down at 8¾. On the other hand, B.E.T. 7 per cent. Preferred stock gained a point.

The metropolitan electric lighting shares are mostly firm. City of London Ordinary rose 10s., and Counties have further improved, there being a fair amount of demand for both. Westminsters are ¼ better. The inquiry has extended to other shares in the London

group, and the market shows a good deal of strength. Brompton and Kensington reacted a trifle after their recent improvement.

One of the disquieting features which have upset markets during the past few days has been the diplomatic friction engendered between the United States and Mexico. Fears were immediately revived that the incident might lead to an outbreak on the part of the Mexican mob, and declines took place in most of the securities connected with the country. A swift recovery followed upon the more pacific news of the early part of this week. The shares and bonds of the utility companies exhibit quite big rises on balance. Mexican Light and Power Common and Preferred advanced 1, but Mexico Trams are 6 points higher at 96½, and both classes of the company's bonds are better. At the same time, Rio and Sao Paulo bonds rallied. Brazil Tractions soared to the extent of 5½ points, "bears" being nearly caught napping. Manaos Trams have gone ahead on a very unexpectedly good report. The Argentine group is a little irregular.

Telegraph descriptions continue firm, and most of the changes in the list show improvements. The Eastern group is good, with Eastern Extensions ⅜ up, to 12⅛, Eastern Telegraph Ordinary stock keeping firm at 128½. West India and Panama shares came into demand upon the buoyancy exhibited by the American market; they are 5s. to the good. Western Telegraph rose to 13, and the Anglo-American group shows pronounced steadiness. Globe Telegraphs are firm, and most of the Debenture stocks in this section are more difficult to buy than they are to sell. Reuters are beginning to throw off the weakness which they have endured for so long, and the price this week shows a 10s. improvement at 9¾. National Telephone Deferred rose to 7½, to react later to 6½. The Marconi group, after being good, went back a little, the parent company's Ordinary and Preference shares exhibiting small net rises on the week, but both have been better than the present quotations. Canadians remained about 8s. 6d.; Americans touched 18s. 3d., reacting later to 17s.

Mackay Common rose 3, with Yankee Rails. American Telephone capital stock is rather higher.

Most of the stocks and shares connected with the Manufacturing group are steady to good. The feature is the strength of India-Rubber shares, which have risen no less than 25s., a small demand sufficing to show the limited number of shares on supply. Henley's put on 5s. Babcock & Wilcox are ⅛ up, the Iron and Steel share market being a good one just now. British Thomson-Houston Debenture fell back to 96½. British Westinghouse Preference are ⅛ higher at 15s.

The Rubber share market has advanced sharply again, and at the Stock Exchange settlement this week it became obvious that the Bear account was still a large one. At the auction sales in Mincing Lane no fresh feature developed of special interest, but the prices obtained were rather better than those which have been ruling of late. It is expected that the Committee, which is sitting to investigate the conditions under which the produce is sold, will be evolving before long some scheme whereby better prices can be obtained, and it is upon the strength of this that hopes of a further rise in prices are built. The market for copper, the metal, has been a little less firm, which to the outsider seems natural enough, in view of the exceedingly sharp rise which it has recently enjoyed. Still, every reaction seems to be followed by further recovery, and the price at the time of writing is close to £70 per ton.

## ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

| Locality. | Month ended (4 wks.) | Receipts for the month. | | No. of weeks. | Total to date. | | Route miles open. | |
|---|---|---|---|---|---|---|---|---|
| | | £ | £* | | £ | £* | | Inc. |
| Bath | July 30 | 4,994 | + 782 | 31 | 28,384 | + 1,356 | .. | .. |
| Blackpool-Fleetw'd | Aug. 2 | 7,488 | + 674 | 4 | 27,488 | + 674 | 8 | .. |
| Bristol | „ 1 | 36,872 | + 6,068 | .. | 239,816 | + 31,384 | 30·5 | .. |
| ‡Brit. Elec. Trac. Co. | „ 1 | 108,9'0 | + 6,396 | .. | 789,579 | + 47,717 | .. | .. |
| Chatham and Dist. | July 31 | 3,906 | + 119 | 30 | 27,(40 | + 1,208 | 14·98 | .. |
| Cork | „ 31 | 2,305 | + 141 | 30 | 14,905 | + 11 | 9·89 | .. |
| Dublin | Aug. 1 | 26,0'7 | + 1,096 | .. | 181,848 | + 4,178 | 54·25 | .. |
| Hastings | July 31 | 4,943 | + 114 | .. | .. | + 1,987 | 19·3 | .. |
| Lancashire United | „ 30 | 6,567 | + 645 | 30 | 44,917 | + 4,464 | 89 | .. |
| Llandudno-Col. Bay | Aug. 1 | 2,446 | + 289 | 35 | 9,8'7 | + 976 | 6·5 | .. |
| London United | „ 1 | 27,8'5 | — 652 | .. | 189,578 | — 1,'65 | .. | .. |
| Tyneside | July 30 | 2,203 | + 89 | 5 | 2,325 | + 33 | 11 | .. |
| Anglo-Argentine | July 29 | 218,982 | +24,956 | .. | ',670,768 | +145,594 | .. | .. |
| Auckland | .. | .. | .. | .. | .. | .. | 24·36 | 1·05 |
| Bombay (B.E.T.) | Aug. 1 | 12,'50 | + 482 | 28 | 87,025 | + 3,318 | .. | .. |
| Brisbane | July | 26,205 | + 3,145 | .. | 177,208 | +46,494 | .. | .. |
| Brit. Columbia Rly. | .. | .. | .. | .. | .. | .. | .. | .. |
| Calcutta | Aug. 2 | 17,366 | +1,080 | .. | .. | + 6,112 | .. | .. |
| Cape Electric T. Ld. | .. | .. | .. | .. | .. | .. | .. | .. |
| Kalgoorlie, W.A. | June | 2,854 | .. | .. | 17,226 | .. | 20·5 | .. |
| Lisbon | .. | .. | .. | .. | .. | .. | .. | .. |
| †Madras | July 31 | 3,720 | + 436 | .. | 25,005 | + 1,870 | 15·25 | i |
| Montevideo | July | 29,189 | +3,754 | .. | 287,602 | +23,745 | .. | .. |
| Cen. London Rly. | Aug. 2 | 17,474 | + 625 | 31 | 1'5,494 | 13,3'8 | 6·78 | ·4 |
| City & S. Lon. Rly. | „ 2 | 10,983 | — 3'9 | 31 | 87,919 | — 8,110 | 7·26 | .. |
| *Dublin-Lucan Rly. | „ 1 | 845 | + 98 | .. | .. | .. | 7 | .. |
| G.N. and City Rly. | .. | .. | .. | .. | .. | .. | 3·5 | .. |
| L'pool Overh'd Rly. | Aug. 3 | 7,906 | + 1,154 | .. | 52,500 | + 4,107 | 6·6 | .. |
| London Elec. Ry. Co. | „ 1 | 50,775 | + 1,970 | 31 | 433,740 | + 5,510 | 21·25 | .. |
| Mersey Railway | „ 2 | 9,025 | + 685 | 31 | 69,271 | + 4,670 | 4·5 | .. |
| Metropolitan Rly. | „ 3 | 68,629 | + 857 | 31 | 521,3'5 | + 3,479 | 25·75 | .. |
| Met. District Rly. | Aug. 2 | 51,011 | +2,428 | 31 | 497,187 | +16,507 | 25 | .. |

* 4½ weeks.

## MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

### Wednesday, August 13th.

| CHEMICALS, &c. | | Latest Price. | Fortnight's Inc. or Dec. |
|---|---|---|---|
| *a* Acid, Hydrochloric .. .. | per cwt. | 5/- | .. |
| *a* „ Nitric .. .. .. | „ | 22/- | .. |
| *a* „ Oxalic .. .. .. | per lb. | 2¾d. | .. |
| *a* „ Sulphuric .. .. .. | per cwt. | 5/6 | .. |
| *a* Ammoniac Sal .. .. .. | „ | 42/- | .. |
| *a* Ammonia, Muriate (large crystal) | per ton | £29 10 | .. |
| *a* Bleaching powder .. .. .. | „ | £6 5 | .. |
| *a* Bisulphide of Carbon .. .. | „ | £18 | .. |
| *a* Borax .. .. .. .. | „ | £17 10 | .. |
| *a* Copper Sulphate .. .. .. | „ | £31 10 | .. |
| *a* Lead, Nitrate .. .. .. | „ | £27 10 | .. |
| *a* „ White Sugar .. .. | „ | £26 | .. |
| *a* „ Peroxide .. .. .. | „ | £32 | .. |
| *e* Methylated Spirit .. .. .. | per gal. | 2/6 | .. |
| *a* Potassium, Bichromate, in casks | per lb. | 3¾d. | .. |
| *a* Potash, Caustic (88/90 %) .. | per ton | £22 10 | .. |
| *a* „ Chlorate .. .. .. | per lb. | 3½d. | .. |
| *a* „ Perchlorate .. .. | „ | 4½d. | .. |
| *a* Potassium, Cyanide (98/100 %) .. (for mining purposes only) | „ | 7½d. | .. |
| *a* Shellac .. .. .. .. | per cwt. | 85/- | .. |
| *a* Sulphate of Magnesia .. .. | per ton | £4 10 | .. |
| *a* Sulphur, Sublimed Flowers .. | „ | £8 10 | .. |
| *a* „ Recovered .. .. | „ | £5 10 | .. |
| *a* „ Lump .. .. .. | „ | £5 | .. |
| *a* Soda, Caustic (white 70/72 %) .. | „ | £10 5 | .. |
| *a* „ Chlorate .. .. .. | per lb. | 3¾d. | .. |
| *a* „ Crystals .. .. .. | per ton | £3 5 | .. |
| *a* Sodium Bichromate, casks .. | per lb. | 3d. | .. |
| **METALS, &c.** | | | |
| *b* Aluminium Ingots, in ton lots .. | per ton | £95 | .. |
| *b* „ Wire, in ton lots (1 to 14 S.W.G.) | „ | £121 6 8 | .. |
| *b* „ Sheet, in ton lots .. | „ | £126 | .. |
| *p* Babbitt's metal ingots .. .. | „ | £50 to £221 | .. |
| *c* Brass (rolled metal 2" to 12" basis) | per lb. | 7¼d. | ¼d. inc. |
| *c* „ Tube (brazed) .. .. | „ | 10d. | inc. |
| *c* „ „ (solid drawn) .. | „ | 8¼d. | inc. |
| *c* „ Wire, basis .. .. .. | „ | 8d. | ¼ inc. |
| *c* Copper Tubes (brazed) .. .. | „ | 11½d. | inc. |
| *c* „ „ (solid drawn) .. | „ | 10⅝d. | inc. |
| *g* „ Bars (best selected) .. | per ton | £85 | £1 inc. |
| *g* „ Sheet .. .. .. | „ | £85 | £1 inc. |
| *g* „ Rod .. .. .. .. | „ | £85 | £1 inc. |
| *d* „ (Electrolytic) Bars .. | „ | £73 | £6 10s. inc. |
| *d* „ „ Sheets .. | „ | £91 | £6 10s. inc. |
| *d* „ „ Rods .. | „ | £78 10 | £6 10s. inc. |
| *d* „ „ H.C. Wire | per lb. | 9½d. | 1d. inc. |
| *f* Ebonite Rod .. .. .. | „ | 4/6 | .. |
| *f* „ Sheet .. .. .. | „ | 4/- | .. |
| *n* German Silver Wire .. .. | „ | 1/10 | .. |
| *h* Gutta-percha, fine .. .. .. | „ | 7/- to 8/- | .. |
| *h* India-rubber, Para fine .. .. | „ | 8/10 | 1d. dec. |
| *l* Iron Pig (Cleveland warrants) .. | per ton | 54/11 | 4d. dec. |
| *l* „ Wire, galv. No. 8, P.O. qual. | „ | £14 | .. |
| *g* Lead, English Pig .. .. .. | „ | £21 5 to £21 10 | .. |
| *m* Manganin Wire No. 28 .. .. | per lb. | 6/6 | .. |
| *g* Mercury .. .. .. .. | per bot. | £7 5 | .. |
| *c* Mica (in original cases) small .. | per lb. | 6d. to 8s. | .. |
| *c* „ „ „ medium | „ | 8/6 to 6/- | .. |
| *c* „ „ „ large .. | „ | 7/6 to 11/- | .. |
| *o* Nickel, sheet, wire, &c. .. .. | „ | 3/6 to 4/6 nom | .. |
| *p* Phosphor Bronze, plain castings | „ | 1/1 to 1/3½ | .. |
| *p* „ „ rolled bars & rods | „ | 1/0½ to 1/3 | .. |
| *p* „ „ rolled strip & sheet | „ | 1/2½ to 1/5½ | .. |
| *o* Platinum .. .. .. .. | per oz. | 185/- | .. |
| *d* Silicium Bronze Wire .. .. | per lb. | 10d. | .. |
| *r* Steel, Magnet, in bars .. .. | per ton | £55 | .. |
| *g* Tin, Block (English) .. .. | „ | £193 to £194 | £9 inc. |
| *n* „ Wire, Nos. 1 to 16 .. .. | per lb. | 2/7 | 1d. inc. |
| *p* White Anti-friction Metals .. | per ton | £50 to £228 | .. |
| *k* Zinc, Sh's (Vieille Montagne bnd.) | „ | £25 5 | 5s. inc. |

Quotations supplied by—

*a* G. Boor & Co.
*b* The British Aluminium Co., Ltd.
*c* Thos. Bolton & Sons, Ltd.
*d* Frederick Smith & Co.
*e* F. Wiggins & Sons.
*f* India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
*g* James & Shakspeare.
*h* Edward Till & Co.
Bolling & Lowe.
*k* Morris Ashby, Ltd.
*l* Richard Johnson & Nephew, Ltd.
*m* W. T. Glover & Co., Ltd.
*n* P. Ormiston & Sons
*o* Johnson, Matthey & Co., Ltd.
*p*
*r* W. F. Dennis & Co.

**Stock Exchange Notices.**—Application has been made to the Committee to appoint a special settling day in and to grant a quotation to—

International Light and Power Co., Ltd.—$1,000,000 six per cent. cumulative preferred stock.

To appoint a special settling day in—

International Light and Power Co., Ltd.—$2,500,000 common stock.

**Marconi's Wireless Telegraph Co., Ltd.**—The directors' report, published yesterday morning, shows that during the year ended December, 1912, the gross profit was £537,243, as compared with £214,407 for 1911. The net profit is £413,295, as compared with £141,717 for 1911. Dividends of 17 per cent. on the preference shares and 20 per cent. on the ordinary for the year, require £42,500 and £149,921 respectively. A reserve fund is started with £100,000, and £146,726 is carried forward. We shall deal with the report more fully in our next issue.

**Tyneside Electrical Development Co., Ltd.**—An interim dividend of 5 per cent. is declared.

# SHARE LIST OF ELECTRICAL COMPANIES.

## ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

| NAME. | Stock or Share. | Dividends for 1911. | Dividends for 1912. | Closing Quotations Aug. 12th. | Rise + or Fall — | Present Yield p.c. |
|---|---|---|---|---|---|---|
| | * | | | | | £ s. d. |
| Bournemouth & Poole, Ord. .. | 10 | 5½ | 6 | 9⅞ — 10⅛ | .. | 5 14 8 |
| Do. 4½ % Pref. .. .. .. | 10 | 4½ | 4½ | 8⅝ — 9⅜ | .. | 4 12 4 |
| Do. Second 6 % Pref. .. | 10 | 6 | 6 | 10⅜ — 10⅝ | .. | 5 12 11 |
| Do. 4½ % Deb. Stock .. .. | Stock | 4½ | 4½ | 95 — 96 | +1½ | 4 11 10 |
| Brompton & Kensington, Ord... | 5 | 10 | 10 | 8½ — 9 | — ⅛ | 5 11 1 |
| Do. 7 % Cum. Pref. .. .. | 5 | 7 | 7 | 8½ — 8⅝ | .. | 4 0 0 |
| Central Electric Supply, 4 % Guar. Deb. | 100 | 4 | 4 | 94 — 97 | .. | 4 2 6 |
| Charing Cross, West End & City | 5 | 5 | 5† | 4⅞ — 4⅝ | .. | 5 5 8 |
| Do. 4½ % Cum. Pref. .. .. | 5 | 4½ | 4½ | 4⅞ — 4⅝ | .. | 4 14 9 |
| Do. "City Undertaking" 4½ % Cum. Pref. | 5 | 4½ | 4½ | 8⅛ — 4 | .. | 5 12 6 |
| Do. Do. 4 % Deb... | 100 | 4 | 4 | 90 — 92 | .. | 4 7 0 |
| Chelsea, Ord. .. .. .. .. | 5 | 5 | 4† | 4⅝ — 5⅛ | .. | 4 17 7 |
| Do. 4½ % Deb. .. .. .. | Stock | 4½ | 4½ | 94 — 97 | .. | 4 12 9 |
| City of London, Ord. .. .. | 10 | 8 | 9 | 15 — 16½ | + ½ | 5 9 1 |
| Do. 6 % Cum. Pref. .. .. | 10 | 6 | 6 | 12 — 13 | .. | 4 12 4 |
| Do. 5 % Deb. .. .. .. | Stock | 5 | 5 | 114 —118 | .. | 4 4 9 |
| Do. 4½ % Second Deb. .. | 100 | 4½ | 4½ | 98 —100 | .. | 4 10 0 |
| County of London, Ord... .. | 10 | 6 | 6 | 11 — 11½ | + ⅛ | 5 4 4 |
| Do. 6 % Pref. .. .. .. | 10 | 6 | 6 | 11½ — 12 | + ⅛ | 5 0 0 |
| Do. 4½ % Deb. .. .. .. | Stock | 4½ | 4½ | 102½ —104½ | + ½ | 4 6 2 |
| Do. 4½ % Second Deb. .. | Stock | 4½ | 4½ | 98 —101 | .. | 4 9 1 |
| Edmundson's, Ord. .. .. | £3 | Nil | .. | ⅜ — ⅝ | .. | Nil |
| Do. 6 % Cum. Pref. .. .. | 5 | Nil | 6 | 4 — 4½ | .. | 3 8 7 |
| Do. 6% Non-Cum. Pref. .. | 5 | .. | .. | 1⅝ — 2 | — ⅛ | .. |
| Do. 4½ % First Mort. Deb. .. | 100 | 4½ | 4½ | 79 — 82 | .. | 5 9 9 |
| Folkestone .. .. .. .. .. | 5 | 6 | 6 | 4½ — 5 | .. | 6 0 0 |
| Do. 5 % Cum. Pref. .. .. | 5 | 5 | 5 | 4½ — 5 | .. | 5 0 0 |
| Do. 4½ % First Deb. .. .. | 100 | 4½ | 4½ | 88 — 90 xd | .. | 5 0 0 |
| Hove .. .. .. .. .. | 5 | 9 | 9† | 7⅞ — 8⅛ | .. | 5 9 1 |
| Kensington & Knightsbridge, Ord | 5 | 9 | 8† | 7½ — 7⅝ | .. | 5 16 2 |
| Do. 4 % Deb. .. .. .. | Stock | 4 | 4 | 88 — 91 xd | .. | 4 7 11 |
| Kent Elec. Power, 4½ % Deb. .. | Stock | 4½ | 4½ | 74 — 78 | .. | 5 15 5 |
| London Electric, Ord. .. .. | 8 | 2½ | 2⅝ | 1⅛ — 1⅜ | .. | 4 7 9 |
| Do. 6 % Pref. .. .. .. | 5 | 6 | 6 | 4⅜ — 5⅛ | .. | 5 17 1 |
| Do. 4 % First Mort. Deb. .. | Stock | 4 | 4 | 88 — 91 | .. | 4 8 0 |
| Metropolitan .. .. .. | 5 | 4 | 4† | 8⅛ — 8⅜ | .. | 5 6 8 |
| Do. 4½ % Cum. Pref. .. .. | 5 | 4½ | 4½ | 4⅛ — 4⅜ | .. | 5 0 0 |
| Do. 4½ % First Mort. Deb. .. | Stock | 4½ | 4½ | 96 — 99 | .. | 4 10 1 |
| Do. 3½ % Mort. Deb. .. .. | Stock | 3½ | 3½ | 77 — 80 | .. | 4 7 6 |
| North Metropolitan Power Supply, 5 % Mortgages (Red.) | 100 | 5 | 5 | 98 —101 | .. | 4 19 0 |
| Notting Hill, 6 % Non-Cum. Pref. | 10 | 6 | 6 | 9⅛ — 10⅛ | .. | 5 14 3 |
| Oxford .. .. .. .. .. | 5 | 7½ | 6† | 6⅞ — 6⅝ | .. | 5 18 9 |
| St. James' and Pall Mall, Ord. | 5 | 10 | 10† | 8⅛ — 8⅜ xd | .. | 5 14 3 |
| Do. 7 % Pref. .. .. .. | 5 | 7 | 7 | 6⅝ — 7 xd | .. | 5 0 0 |
| Do. 3½ % Deb. .. .. .. | 100 | 3½ | 3½ | 82½ — 85½ | .. | 4 1 10 |
| South London, Ord. .. .. | 4 | 5 | 5½ | 2⅜ — 2½ | .. | 7 0 9 |
| Do. 5 % First Mort. Deb. .. | 100 | 5 | 5 | 96 — 99 | .. | 5 1 0 |
| South Metropolitan, 7 % Pref... | 1 | 7 | 7 | 1⅜ — 1⅝ | .. | 5 17 11 |
| Do. 4½ % First Deb. Stock .. | 100 | 4½ | 4½ | 96 — 99 | .. | 4 10 6 |
| Urban, Ord... .. .. .. | £3 | Nil | Nil | ½ — ⅝ | .. | .. |
| Do. 5 % Cum. Pref. .. .. | 5 | 2 | 3 | 2⅝ — 2⅞ | .. | .. |
| Do. 4½ % First Mort. Deb. .. | 100 | 4½ | 4½ | 85 — 88 | .. | 5 2 3 |
| Westminster, Ord. .. .. | 5 | 10 | 10 | 8½ — 8⅝ | + ⅛ | 5 14 3 |
| Do. 4½ % Cum. Pref. .. .. | 5 | 4½ | 4½ | 4⅝ — 5⅛ | .. | 4 5 9 |

## COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

| | | | | | | |
|---|---|---|---|---|---|---|
| Adelaide, 6 % Pref. .. .. | 5 | 6 | 6 | 5 — 5⅛ | .. | 5 14 8 |
| Calcutta, Ord. .. .. .. | 5 | 8½ | 8½ | 7 — 7⅛ | .. | 5 13 4 |
| Do. 5 % Pref. .. .. .. | 5 | 5 | 5 | 5 — 5⅛ | —1/16 | 4 15 3 |
| Calgary Power, 1st Mort. Bds. | 100 | 5 | 5 | 90 — 92 | .. | 5 8 8 |
| Canadian Gen. Elt. Com. .. | $100 | 7 | 7 | 108 —112 | .. | 6 5 0 |
| Do. 7 % Pref. .. .. .. | $100 | 7 | 7 | 119 —124 | +1 | 5 12 11 |
| Cordoba Lt., Power and T., Ord. | 1 | 3 | 5 | ⅞ — 1⅛ | .. | 6 8 1 |
| Do. 5 % Deb. .. .. .. | 100 | 5 | 5 | 93½ — 95½ | .. | 5 4 9 |
| Elec. Lt. and P. of Cochabamba, 5 % Bonds | 100 | 6 | 6 | 90 — 92 | .. | 6 10 5 |
| Elec. Supply Victoria, 5 % 1st Mort. Deb. | 100 | 5 | 5 | 87½ — 90½ | .. | 5 10 6 |
| Elec. Dev. Ontario, 5 % 1st Mort. Bonds | $500 | 5 | 5 | 91½ — 93½ | — ½ | 5 6 11 |
| Kalgoorlie Elec. P. and Lt., Ord. | 10/- | Nil | .. | 1/32 — 3/32 | .. | Nil |
| Do. 6 % Pref. .. .. .. | 1 | 6 | 6 | 9/16 — 5/8 | .. | 9 12 0 |
| Kaministiquia Power, 5 % G. Bs. | $500 | 5 | 5 | 101 —103 | +1 | 4 17 1 |
| Madras, Ord. .. .. .. | £ | Nil | .. | 1¼ — 1⅝ | .. | .. |
| Melbourne, 5 % 1st Mort. Deb. | 100 | 5 | 5 | 103 —106 | .. | 4 14 4 |
| Mexican El. Lt., 5 % 1st M. Bds. | .. | 5 | 5 | 74 — 77 | .. | 6 9 10 |
| Mexican Lt. & Power, Common | $100 | 4 | 4† | 62 — 64 | +1 | 6 5 0 |
| Do. 7 % Cum. Pref. .. .. | $100 | 7 | 7 | 93 — 98 | +1 | 7 2 10 |
| Do. 5 % 1st Mort. Gold Bds. | .. | 5 | 5 | 85 — 88 xd | .. | 5 13 8 |
| Do. 5 % 2nd Mort. Bonds .. | 100 | 5 | 5 | 74 — 77 | .. | 6 9 10 |
| Monterey Rly. Light & Power, 5 % 1st Mort. Deb. | 100 | 5 | 5 | 76 — 79 xd | .. | 6 6 7 |
| Montreal, Lt., H. and Power .. | $100 | 8 | 9† | 207 —217 xd | .. | 4 2 7 |
| Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds | $500 | 5 | 5a | 15 — 25 | .. | .. |
| River Plate, Ord. .. .. .. | Stock | 10 | 10 | 207 —217 | .. | 4 8 0 |
| Do. 6 % Non-Cum. Pref. .. | Do. | 6 | 6 | 102 —107 | .. | 5 9 1 |
| Do. 5 % Deb. Stock .. .. | Do. | 5 | 5 | 97½ — 99½ | .. | 4 19 6 |
| Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb. | 100 | 4½ | 4½ | 100 —102 | .. | 4 8 8 |
| Shawinigan Water, Capital .. | $100 | 5 | 5½ | 126 —130 | +2 | 4 4 7 |
| Do. 5 % Con. 1st Mort. Bonds | $500 | 5 | 5 | 104½ —106½ | .. | 4 14 0 |
| Do. 4½ % Per. Deb. .. .. | Stock | 4½ | 4½ | 99¼ —102½ | + ⅛ | 4 7 10 |
| Toronto Power, 4½ % Deb. .. | Do. | 4½ | 4½ | 97 —100 | .. | 4 10 0 |
| Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb. | 100 | 5 | 5 | 90½ — 92½ | .. | 5 8 1 |
| Victoria Falls Power, Pref. .. | 1 | 11½d. | 17⅛d. | 11/16 — 13/16 | .. | .. |
| West Kootenay Power and Lt., 1st Mort. 6 % Gold | 100 | 6 | 6 | 106 —108 | .. | 5 11 1 |

## TELEGRAPH AND TELEPHONE COMPANIES.

| | | | | | | |
|---|---|---|---|---|---|---|
| Amazon Telegraph .. .. | 10 | 4 | 4½† | 6⅞ — 7⅜ | .. | 6 2 0 |
| Do. 5 % Deb. Red. .. .. | Stock | 5 | 5 | 9⅜ — 9⅝ | .. | 5 4 9 |
| American Telep. & Teleg., Cap. | $100 | 8 | 8 | 130½ —133½ | + ½ | 5 19 10 |
| Do. Collat. Trust .. .. | $1000 | 4 | 4 | 90½ — 92½ | .. | 4 6 6 |
| Anglo-American Telegraph .. | Stock | 8 | 8 | 60 — 63 | .. | 4 15 3 |
| Do. 6 % Pref. .. .. .. | Do. | 6 | 6 | 108 —109 | .. | 5 10 1 |
| Do. Def... .. .. .. .. | Do. | 80/- | 80/- | 28⅛ — 28⅝ | .. | 6 7 0 |
| Anglo-Portuguese Tel., 5 % Mort. Deb. | 100 | 5 | 5 | 104 —106 | .. | 4 15 8 |
| Chili Telephone .. .. .. | 5 | 7 | 8 | 7⅝ — 7⅞ xd | .. | 5 5 10 |
| Commercial Cable, Stlg. 4 % Deb. | Stock | 4 | 4 | 82½ — 84½ | .. | 4 14 8 |
| Cuba Telegraph .. .. .. | 10 | 6 | 6 | 8½ — 9½ | .. | 6 6 4 |
| Do. 10 % Pref. .. .. .. | 10 | 10 | 10 | 15½ — 16½ | .. | 5 19 4 |
| Direct Spanish Telegraph, Ord. | 5 | 4 | 4† | 8⅛ — 8⅜ | .. | 5 6 8 |
| Do. 10 % Cum. Pref. .. .. | 5 | 20 | 10 | 6¾ — 7¼ | .. | 6 12 0 |
| Direct United States Cable .. | 10 | 5 | 4 | 6¾ — 7¼ xd | .. | 5 10 4 |
| Direct W. India Cable, 4½ % Reg. Deb. | 100 | 4½ | 4½ | 98 —100 | .. | 4 10 0 |
| Eastern Telegraph, Ord. Stock | Stock | 7 | 7† | 127 —130 | .. | 5 7 8 |
| Do. 8½ % Pref. Stock... .. | Do. | 8½ | 8½ | 75½ — 77½ | .. | 4 10 4 |
| Do. 4 % Mort. Deb. .. .. | Do. | 4 | 4 | 94½ — 96½ | +1½ | 4 2 11 |
| Eastern Extension .. .. | 10 | 7 | 7 | 12⅜ — 12¾ | + ⅛ | 5 8 9 |
| Do. 4 % Deb. .. .. .. | Stock | 4 | 4 | 92 — 94 xd | .. | 4 5 1 |
| East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub. | 25 | 4 | 4 | 99 —101 | .. | 3 19 8 |
| Globe Telegraph and Trust .. | 10 | 6 | 6† | 10⅜ — 11½ | .. | 5 6 8 |
| Do. 6 % Pref. .. .. .. | 10 | 6 | 6 | 12 — 12¾ | + ⅛ | 4 16 0 |
| Great Northern Telegraph .. | 10 | 18 | 20 | 30 — 32 | + ½ | 6 13 0 |
| Indo-European Telegraph .. | 25 | 13 | 13 | 55 — 57 | .. | 5 14 0 |
| Mackay Companies Common .. | $100 | 5 | 5 | 82 — 84 | +⅛ | 5 19 1 |
| Do. 4 % Cum. Pref. .. .. | $100 | 4 | 4 | 66 — 70 | .. | 5 14 4 |
| Marconi's Wireless Telegraph | 1 | 20 | .. | 3⅝ — 3¾ | + 1/16 | 5 6 8 |
| Do. 7 % Cum. Partic. Pref. | 1 | 17 | .. | 3 — 3⅛ | + ⅛ | 5 4 7 |
| Monte Video Telephone, Ord. .. | 1 | 6 | 6† | 1 — 1⅛ | .. | 5 6 8 |
| Do. 5 % Pref. .. .. .. | 1 | 5 | 5 | ⅜ — ½ | .. | 5 14 3 |
| New York Telep., 4½ % Gen. Bnds. | 100 | 4½ | 4½ | 99½ —100½ | + ½ | 4 9 9 |
| Oriental Telep. and Elec. .. | 1 | 8 | 10 | 13⅜ — 13⅝ | .. | 5 8 6 |
| Do. 6 % Cum. Pref. .. .. | 1 | 6 | 6 | 1⅛ — 1⅜ | .. | 4 16 0 |
| Do. 4 % Red. Deb. .. .. | Stock | 4 | 4 | 86½ — 88½ | .. | 4 10 5 |
| Pacific and European Tel., 4 % Guar. Debs. | Do. | 4 | 4 | 96 — 98 | .. | 4 1 8 |
| Reuter's .. .. .. .. .. | 10 | 10 | 10 | 9½ — 10 | + ½ | 10 0 0 |
| Submarine Cables Trust .. .. | Cert. | 6 | 6 | 124 —127 | .. | 4 14 6 |
| Telephone Co. of Egypt, 4½ % Deb. Red. | Stock | 4½ | 4½ | 95 — 97 | .. | 4 12 9 |
| United River Plate Telephone | 5 | 8 | 8† | 6½ — 7 | .. | 5 14 4 |
| Do. 5 % Cum. Pref. .. .. | 5 | 5 | 5 | 5 — 5½ | .. | 4 11 0 |
| West Coast of America .. .. | 2½ | 2½ | .. | 1⅜ — 1⅞ | .. | 4 3 4 |
| Do. 4 % Debs., 1 to 500 guar. by Bras. Sub. Tel. | 100 | 4 | 4 | 93 — 96 | .. | 4 1 8 |
| West India and Panama Teleg. | 10 | 1½ | 1½ | 2⅜ — 2⅝ | + ⅛ | 4 8 10 |
| Do. 6 % Cum. 1st Pref. .. | 10 | 6 | 6 | 9⅜ — 10½ | + ⅛ | 5 18 5 |
| Do. 6 % Cum. 2nd Pref. .. | 10 | 6 | 6 | 9⅜ — 9¾ | .. | 6 1 6 |
| Do. 5 % Debs. .. .. .. | 100 | 5 | 5 | 99 —101 | .. | 4 19 0 |
| Western Telegraph, Ltd. .. | 10 | 7 | 7† | 12⅜ — 13¼ | + ⅛ | 5 5 8 |
| Do. 4 % Deb. .. .. .. | Stock | 4 | 4 | 90½ — 92½ | .. | 4 6 6 |
| Western Union 4½ % Fdg. Bonds | $1000 | 4½ | 4½ | 90 — 93 | .. | 4 16 9 |

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 3s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE

## SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

### ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

| NAME. | Stock or Share. | Dividends for 1911. | Dividends for 1912. | Closing Quotations Aug. 12th. | Rise + or Fall — | Present Yield p.c. £ s. d. |
|---|---|---|---|---|---|---|
| Bath Trams, Pref. Ord. | * | Nil | Nil | 3/16 — 5/16 | .. | Nil |
| Do. 5 % Pref. | 1 | 5 | 5 | 3 9/32 — 3 11/32 | .. | 6 8 0 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 72 — 77 | .. | 5 17 0 |
| Brit. Elec. Trac., 6 % Pref. | 100 | .. | .. | 7⅛ — 9⅛ | — ½ | .. |
| Do. Do. Deferred | 100 | .. | .. | 3¼ — 5½ | .. | .. |
| Do. Do. 6 % Cum. Pr't | 100 | 6 | 6 | 78 — 81 | .. | 7 8 2 |
| Do. 7 % Non-Cum. Pr't. | 100 | .. | 3 | 38 — 41 | +1 | 7 6 4 |
| Do. 5 % Perp. Deb. | 100 | 5 | 5 | 90 — 93 | .. | 5 7 6 |
| Do. 4½ % 2nd Deb. | 100 | 4½ | 4½ | 72 — 76 | .. | 5 18 5 |
| Central London Railway, Ord. | 100 | 3 | 3 | 73 — 75 xd | .. | 4 0 0 |
| Do. Gtd. Assented | 100 | .. | .. | 81 — 83 | +1 | 4 16 5 |
| Do. Pref. | 100 | 4 | 4 | 78 — 80 xd | .. | 5 0 0 |
| Do. Gtd. Assented | 100 | .. | .. | 82 — 84 | .. | 4 15 3 |
| Do. Def. | 100 | 2 | 2 | 75 — 77 | .. | 2 12 0 |
| Do. Gtd. Assented | 100 | .. | .. | 79 — 81 | +1 | 4 18 9 |
| Do. 4 % Deb. | 100 | 4 | 4 | 97 — 99 | .. | 4 0 10 |
| City & S. London, 5 % Pref., 1891 | 100 | 5 | 5 | 98 —100 xd | —1 | 5 0 0 |
| Do. Do. 1896 | 100 | 5 | 5 | 98 —100 xd | .. | 5 0 0 |
| Do. Do. 1901 | 100 | 5 | 5 | 97 — 99 xd | .. | 5 1 0 |
| Do. Do. 1908 | 100 | 5 | 5 | 97 — 99 xd | +1 | 5 1 9 |
| Do. 4 % Deb. | 100 | 4 | 4 | 92 — 94 | .. | 4 5 1 |
| Great Northern & City, Pr't. Ord | 10 | Nil | Nil | 2¼ — 2⅝ | .. | Nil |
| Hastings Trams, 6 % Pref. | 1 | 6 | 6† | 17/32 — 19/32 | .. | 7 13 7 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 65 — 73 | .. | 6 3 3 |
| sle of Thanet Trams, 5 % Pref. | 5 | 2½ | 2½ | 2¼ — 2⅝ | .. | 4 15 3 |
| Do. 4 % Deb. | 100 | 4 | 4 | 73 — 78 | .. | 5 2 7 |
| Lancashire United, 5 % Deb. | 100 | 5 | 5 | 76 — 78 | .. | 6 8 2 |
| London and Suburban, Ord. | 1 | .. | .. | 1/16 — 3/32 | .. | .. |
| Do. Do. 5 % Cum. Pref. | 1 | .. | .. | 5/32 — 11/32 | .. | .. |
| Do. Do. 4½ % 1st. Deb. | 100 | .. | 4½ | 65 — 75 | .. | 6 0 0 |

| NAME. | Stock or Share. | Dividends for 1911. | Dividends for 1912. | Closing Quotations Aug. 12th. | Rise + or Fall — | Present Yield p.c. £ s. d. |
|---|---|---|---|---|---|---|
| London Elec. Railw'ys, 4 % Deb. | 100 | | 4 | 91 — 93 | .. | 4 6 0 |
| London United Trams, 4 % Deb. | 100 | 4 | 4 | 60 — 64 | +1 | 6 5 0 |
| Metropolitan Railway Consol. | 100 | 17 | 18 | 48 — 48½ | +3½ | 3 7 0 |
| Do. Surplus Lands | 100 | 2⅝ | 2⅝ | 59 — 61 xd | .. | 4 10 2 |
| Do. 3½ % Deb. | 100 | 3½ | 3½ | 83 — 85 xd | .. | 4 2 4 |
| Do. 3½ % Pref. | 100 | 3½ | 3½ | 81 — 83 xd | .. | 4 4 4 |
| Do. 3½ % Con. Pref. | 100 | 3½ | 3½ | 77 — 79 xd | .. | 4 8 7 |
| Metropolitan District Ord. | 100 | Nil | Nil | 35 — 35½ | + 2 | Nil |
| Do. 6 % Deb. | 100 | 6 | 6 | 136 —139 | .. | 4 6 4 |
| Do. 4 % Deb. | 100 | 4 | 4 | 92 — 94 | .. | 4 5 1 |
| Do. 4 % Prior Lien | 100 | 4 | 4 | 95 — 97 | .. | 4 2 6 |
| Do. 4½ % First Pref. | 100 | 4½ | 4½ | 81 — 83 xd | .. | 5 8 3 |
| Do. 3½ % Gtd. | 100 | 3½ | 3½ | 74 — 76 xd | .. | 4 12 1 |
| Metro. Elec. Trams, 4½ % Deb. | 100 | 4½ | 4½ | 84 — 88 | .. | 5 2 3 |
| Do. 5 % Deb. | 100 | 5 | 5 | 91 — 94 | — ½ | 5 6 5 |
| Potteries, Ord. | 1 | 3½ | 3½ | 9/32 — 11/32 | .. | .. |
| Do. 5 % Pref. | 1 | 6 | 6 | 11/16 — 13/16 | .. | 7 5 6 |
| Do. 4½ % Deb. | 100 | 4 | 4½ | 82 — 85 | .. | 5 6 0 |
| South Metro. Trams, 6 % Pref. | 1 | .. | .. | 2/32 — 3/32 | .. | 8 0 0 |
| Do. 4 % Deb. | 100 | .. | 4 | 63 — 68 | .. | 5 17 8 |
| Underground Elec. Railways | 10 | .. | .. | 3 7/16 — 4 1/16 | + ⅛ | Nil |
| Do. "A" | 1/- | 4½ | .. | 2/32 — 3/32 | .. | Nil |
| Do. 6% First Cum. Inc. Deb. | 100 | 1⅜ | 6 | 111 —113 | +1 | 5 6 2 |
| Do. 4½ % Bonds | 100 | Nil | 4½ | 99 —101 | +1 | 4 9 1 |
| Do. 6 % Income | 100 | 3 | 6 † | 94 — 95 | +3 | 6 6 4 |
| Yorkshire (West Riding), Ord. | 5 | .. | .. | 1/16 — 3/32 | .. | Nil |
| Do. 6 % Pref. | 5 | .. | 3† | 3 9/32 — 4 | .. | .. |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 81 — 85 | .. | 5 6 0 |

### ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

| | | | | | | |
|---|---|---|---|---|---|---|
| Anglo-Arg. Trams, 1st Pref. | 5 | 5⅛ | 5⅛ | 4 11/16 — 5 5/16 | — 1/16 | 5 11 4 |
| Do. 2nd Pref. | 5 | 5⅛ | 5⅛ | 4 5/16 — 4 7/16 | + ⅛ | 6 0 7 |
| Do. 4 % Deb. | 100 | 4 | 4 | 91 — 93 | .. | 4 6 0 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 94½ — 96½ | .. | 4 13 3 |
| Do. 5 % Deb. | 100 | 5 | 5 | 97 — 99 | .. | 5 1 0 |
| Auckland Trams, 5 % Deb. | 100 | 5 | 5 | 100 —102 | .. | 4 18 0 |
| Bombay Elec. S. & Trams, Pref. | 10 | 6 | 6 | 10⅜ — 11½ | — ⅛ | 5 4 4 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 94 — 96 | .. | 4 13 9 |
| Do. 5 % 2nd Deb. | 100 | 5 | 5 | 96 — 99 | .. | 5 1 0 |
| Brazilian Traction Light and Power | $100 | .. | 6† | 92½ — 94½ | +5½ | 6 7 0 |
| Brisbane Trams Invt., Ord. | 5 | 8 | 8 | 6⅞ — 7⅞ | .. | 5 8 6 |
| Do. 5 % Pref. | 5 | 5 | 5 | 4½ — 5⅛ | .. | 4 8 11 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 97 —100 | .. | 4 10 0 |
| B. Columbia Elec. Rly., Def. | 100 | 8 | 8† | 124 —129 | +1 | 6 4 0 |
| Do. Pref. Ord. | 100 | 6 | 6 | 109 —114 xd | .. | 5 5 3 |
| Do. 5 % Pref. | 100 | 5 | 5 | 102½ —105½ xd | .. | 4 14 9 |
| Do. 4½ % 1st Mort. Deb. | 40 | 4½ | 4½ | 100 —103 | .. | 4 7 5 |
| Do. 4½ % Vancouver Deb. | 100 | 4½ | 4½ | 100 —102 xd | .. | 4 8 3 |
| Do. 4½ % Con. Deb. | 100 | 4½ | 4½ | 95½ — 97½ | .. | 4 7 2 |
| Calcutta Trams, Ord. | 6 | 7 | 5† | 5⅞ — 6⅛ | .. | 5 12 0 |
| Do. 5 % Pref. | 5 | 5 | 5 | 4⅞ — 5⅛ | + 1/16 | 4 17 7 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 95½ — 98½ | .. | 4 11 5 |
| Cape Electric Trams | 1 | 2½ | 5 | 1/16 — 1/32 | .. | 6 3 1 |
| City Buenos Aires Trams (1904) | 5 | 5 | 5† | 5⅜ — 5⅝ | + 1/16 | 4 8 11 |
| Do. 4 % Deb. | 100 | 4 | 4 | 92 — 97 | .. | 4 2 6 |
| Colombo Elec. Tr. & Lt., 5 % Deb. | 100 | 5 | 5 | 90½ — 94½ | .. | 5 5 10 |
| Havana Elec. Rly., 5 % Bonds | $1000 | 5 | 5 | 94½ — 98½ | .. | 5 1 6 |
| Kalgoorlie Elec. Trams | 1 | Nil | .. | 3/16 — 5/16 | .. | Nil |
| Do. 5 % A Deb. | 100 | 5 | 5 | 85 — 90 | .. | 5 11 1 |
| Do. 5 % B Deb. | 100 | 6 | 8 | 95 — 85 | .. | .. |

| | | | | | | |
|---|---|---|---|---|---|---|
| La Plata Elec. Trms, Ord. | 1 | Nil | .. | 13/32 — 17/32 | .. | .. |
| Do. Pref. | 1 | 6 | .. | 29/32 — 1 3/32 | .. | 5 16 6 |
| Lisbon Elec. Trams, Ord. | 1 | 6 | 4½d. | 1 3/32 — 1 5/32 | .. | 4 9 8 |
| Do. 6 % Pref. | 1 | 6 | 6 | 1 — 1 1/32 | .. | 4 16 0 |
| Do. 5 % Deb. | 100 | 5 | 5 | 91 — 96 | .. | 5 4 2 |
| Madras Elec. Tr. 6% Cum. Pref. | 5 | .. | 6 | 4 3/4 — 5 1/8 | .. | 5 17 1 |
| „ Elec. Tr. (1904), Deb. | 100 | 5 | 5 | 101 —103 | .. | 4 17 1 |
| Manaos Trams & Lt., 1st Deb. | 100 | 5 | 5 | 86½ — 89½ | .. | 5 11 9 |
| Manila Elec. R. and Lig., Bonds | $1000 | 5 | 5 | 99 — 101 | .. | 4 19 0 |
| Mexico Trams Com. | $100 | 7 | 7† | 95 — 98 | +6 | 7 2 10 |
| Do. Gen. Con. 5 % Bonds | .. | 5 | 5 | 88 — 91 | +1 | 5 9 11 |
| Do. 6 % Bonds | 100 | 6 | 6 | 87 — 90 | +1 | 6 13 4 |
| Para Elec. Rlys. & Lt., Ord. | 5 | 10 | 10 | 6⅛ — 6½ | .. | 7 13 10 |
| Do. 6 % Pref. | 5 | 6 | 6 | 4 7/8 — 5⅛ | + ⅛ | 5 17 1 |
| Do. 5 % 1st Deb. | 100 | 5 | 5 | 98½ —100½ | + ½ | 4 19 6 |
| Perth (W.A.) Elec. Tr., Ord. | 1 | 5 | 5½ | 1⅛ — 1⅜ | .. | 4 0 0 |
| Rangoon El. Tr. & Sup., Pref. | 5 | 6 | 6 | 5 — 5½ | .. | 5 9 1 |
| Do. 4½ % 1st Deb. | 100 | 4½ | 4½ | 95 — 97 | .. | 4 12 9 |
| Rio de Janeiro Trams, 1st Mort. 5 % Bonds | .. | 5 | 5 | 100 —102 | +1½ | 4 18 0 |
| Do. 5 % Mort. Bonds | 100 | 5 | 5 | 95 — 97 | +2 | 5 8 1 |
| Sao Paulo Tram, Lt. and P. 5 % 1st Deb. | $500 | 5 | 5 | 101 — 103 | +1 | 4 17 1 |
| Singapore Trams, 5 % Deb. | 100 | 5 | 5 | 85 — 89 | .. | 5 12 4 |
| Southern El. Tr. B.A., 5 % Deb. | 100 | 5 | 5 | 94½ — 96¼ xd | .. | 5 3 8 |
| Un. Elec. Trams Monte Video | 5 | 7 | 7 | 4⅜ — 5 | + ⅛ | 7 0 0 |
| Do. 6 % Pref. | 5 | 6 | 6 | 4 3/4 — 5⅛ | .. | 5 17 1 |
| Do. 5 % 1st Deb. | 100 | 5 | 5 | 97 —100 | .. | 5 0 0 |
| Winnipeg Elec. Rly., 4½ % Deb. | 100 | 4½ | 4½ | 100 —102 | + ½ | 4 8 3 |

### MANUFACTURING COMPANIES.

| | | | | | | |
|---|---|---|---|---|---|---|
| Aron, Ord. | 1 | 6 | .. | 3/32 — 1/8 | .. | 7 7 8 |
| Do. 6 % Pref. | 1 | 6 | 6 | 3/32 — 3/32 | .. | 7 2 6 |
| Babcock & Wilcox | 1 | 28 | 16 | 3 — 3¼ | + ⅛ | 5 2 5 |
| Do. Pref. | 1 | 6 | 6 | 1¾ — 1⅞ | .. | 4 7 8 |
| British Aluminium, Ord. | 1 | Nil | .. | 1/32 — 1/16 | .. | .. |
| Do. 6 % Cum. Pref. | 1 | Nil | 6 | 3/32 — 1/8 | .. | 5 17 2 |
| Do. 5 % Prior Lien Debs. | 100 | 5 | 5 | 91 — 94 | .. | 5 4 2 |
| Do. Deb. Stk. | 100 | 5 | 5 | 82 — 85 | .. | 5 17 8 |
| B.I. & Helsby Cables | 5 | 10 | 10 | 7⅛ — 8 | .. | 6 5 0 |
| Do. Pref. | 5 | 6 | 6 | 5½ — 6½ xd | .. | 4 16 0 |
| Do. Deb. | 100 | 4½ | 4½ | 99 —102 | .. | 4 8 3 |
| British Thomson-Houston, Deb. | 100 | 4½ | 4½ | 95 — 98 | —1½ | 4 11 10 |
| British Westinghouse, Pref. | 8 | Nil | Nil | 5/8 — 7/8 | + 1/16 | Nil |
| Do. Deb. | 100 | 4 | 4 | 62 — 66 | .. | 6 1 3 |
| Do. 6 % Prior Lien | 100 | 6 | 6 | 100 —103 | .. | 5 16 6 |
| Browett, Lindley, Ord. | 1 | .. | .. | 2/- —3/- | .. | Nil |
| Do. Pref. | 1 | .. | .. | 4/6 —5/- | .. | Nil |
| Brush, 7 % Pref. | 2 | Nil | Nil | 0 — ½ | .. | Nil |
| Do. 5 % Prior Lien Deb. | 100 | 5 | 5 | 70½ — 75½ | .. | 6 12 5 |
| Do. 4½ % Deb | 100 | 4½ | 4½ | 38 — 43 | .. | 10 9 4 |
| Do. 4½ % Second Deb. | 100 | 4½ | 4½ | 23 — 27 | .. | 16 13 4 |
| Callender's Cable | 5 | 15 | 15 | 10⅜ — 11⅜ | .. | 6 11 10 |
| Do. Pref. | 5 | 5 | 5 | 4 13/16 — 5 1/16 | .. | 4 18 9 |
| Do. Deb. | 100 | 4½ | 4½ | 96 — 99 | .. | 4 10 6 |
| Castner-Kellner | 1 | 20 | 20 | 8 1/16 — 8 1/8 | .. | 5 4 11 |
| Do. Deb. | 100 | 4½ | 4½ | 102 —105 xd | .. | 4 5 9 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Crompton & Co., Deb. | 100 | 5 | 5 | 54½ — 59½ | .. | 8 8 0 |
| Dick, Kerr | 1 | 5 | Nil | 3/4 — 7/8 | .. | .. |
| Do. Pref. | 1 | 6 | 6 | 13/16 — 15/16 | .. | 7 13 10 |
| Edison & Swan, A, £8 paid | 5 | Nil | .. | 0 — 1/8 | .. | Nil |
| Do. fully paid | 5 | Nil | .. | 1/4 — 1/2 | .. | Nil |
| Do. 4 % Deb. | 100 | 4 | 4 | 58 — 62 | .. | 6 9 1 |
| Do. 5 % Second Deb. | 100 | 5 | 5 | 65 — 70 | .. | 7 2 10 |
| Electric Construction | 2 | 8½ | 5 | 1 — 1 1/32 xd | .. | 8 0 0 |
| Do. Pref. | 2 | 7 | 7 | 1 13/16 — 2 1/16 xd | .. | 6 15 9 |
| Greenwood & Batley, Pref. | 10 | 7 | 7 | 7/8 — 8 | .. | 8 6 8 |
| Do. Deb. | 100 | 5 | 6 | 92 — 94 | .. | 5 4 2 |
| General Electric, 6% Pref. | 10 | 5 | 6 | 9½ — 10½ | .. | 5 14 3 |
| Do. Deb. | 100 | 4 | 4 | 89 — 94 | .. | 4 5 1 |
| Henley's, Ord. | 5 | 15 | 15 | 12½ — 13 | + ½ | 5 15 5 |
| Do. Pref. | 5 | 4½ | 4½ | 4½ — 5 | .. | 4 10 0 |
| Do. Deb. | 100 | 4½ | 4½ | 100 —102 | .. | 4 8 3 |
| India-Rubber, G. & T. | 10 | .. | 7½ | 12¾ — 13¾ | +1½ | 5 9 1 |
| Do. Pref. | 10 | 5 | 5 | 9 — 10 | .. | 5 0 0 |
| Telegraph Construction | 12 | 17½ | 20 | 35 — 37 | .. | 6 7 2 |
| Do. Deb. | 100 | 4 | 4 | 95 — 97 | .. | 4 2 6 |
| Willans & Robinson | 1 | Nil | .. | 1/16 — 3/16 | .. | Nil |
| Do. Pref. | 5 | Nil | .. | 1/4 — 1/2 | .. | Nil |
| Do. Deb. | 100 | 4 | 4 | 55 — 57 | .. | 7 0 4 |

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4½ per cent., April 17th, 1913.

# THE BILLITER-SIEMENS ELECTROLYTIC ALKALI CELL AND PROCESS.

By JOHN B. C. KERSHAW.

The Billiter-Siemens cell is protected by English patent No. 7,757 of 1907, and is the invention of Dr. Jean Billiter, of Vienna. Since the patent was granted the cell has been thoroughly tested on a practical industrial scale at the Kaliwerke Aschersleben in Germany, and at two small installations of a similar character in Austria, and the patent rights for Europe have passed into the hands of Messrs. Siemens and Halske, of Berlin, while the Kaliwerke Aschersleben control the American and Colonial rights. At the present date there are five works in operation where the Billiter-Siemens cell and process are employed, the most important

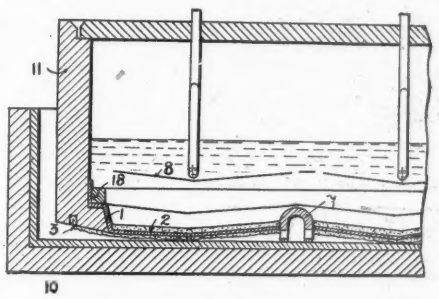



Fig. 1.

of these being the installation at the works of the Niagara Alkali Co., successors to the old Roberts Chemical Co. Details of these five installations of the Billiter-Siemens cell and process are given in Table I, and it may be remarked that the Niagara plant is at present being enlarged to three times its original size, and that 3,000 kw. will be ultimately required for operating the cells at this factory.

## Description of Cell and Cell Process.

The Billiter-Siemens cell is a combination of the "bell" type of gravity cell and a horizontal diaphragm, by means of which the known disadvantages of this type of cell are minimised. These disadvantages were fully demonstrated during the trials of the Richardson & Holland bell-type of

TABLE I.—Locality and Capacity of Works employing the Billiter-Siemens Diaphragm Cell.

| Title of firm and locality of works. | No. of cells. | Capacity of cells. | kw. utilised. |
|---|---|---|---|
| Kaliwerke Aschersleben Akt. Gesell. (Aschersleben, Saxony) ... ... | 10 | 2,000 amps. | 100 |
| Bosnische Elektricitäts Akt. Gesellschaft (Brückl, Austria) ... ... | 64 | 2,500 amps. | 650 |
| Ignaz Spiro & Sohne (Krummauer, Bohemia) ... ... ... ... | 32 | 500 amps. | 65 |
| Farb-Werke Höchst (Höchst, Germany) ... ... ... ... | ? | ? | ? |
| Niagara Alkali Co. (Niagara Falls) | 50 | 3,000 amps. | 1,000 |

cell, by the Electrochemical Co. at St. Helens, in the years 1895-1900, and the disappointing results that followed the erection and equipment of this works have handicapped the development of electrolytic alkali processes in this country, even down to the present date. A second attempt to work this type of cell was made in 1899, at Aussig, in Austria, by the Oest Verein fur Chemische Production, and here greater success was achieved. A low concentration of sodium hydrate is, however, only possible with the open gravity type of cell, and according to Allmand* not more than 6,000 h.p. is utilised at the present moment in the Aussig and other works using this cell and process. The Billiter-Siemens cell, one of the latest developments of the bell-type of cell, is shown diagrammatically in figs. 1 and 2. Fig. 1 is portion of a longitudinal section of the cell; while fig. 2 is a cross-section of the whole cell, drawn on a reduced scale, as compared with fig. 1.

As described in the patent specification, the cell consists of a bell (11) which is closed at the bottom by a diaphragm (2). The latter rests on an iron or nickel wire net (3) which serves as the negative electrode. The bell stands in a vessel (10). In the inside of the bell is the anode (8), made of platinum or carbon—this is placed parallel to and at a short distance from the cathode wire net (3).

In order to permit of a complete separation of the products of electrolysis (soda-lye and chlorine), the cell is operated as follows:—The bell is filled with the electrolyte to a pre-determined height, whilst the outer vessel (10) remains at first empty. Since the diaphragm is pervious to liquids, the common salt solution works through to the cathode, and forms there soda-lye. The outlet (13) for the lye is in such a position, and of such dimensions, that the liquid in the outer vessel just washes the cathode wire net. In order to allow easy exit for the hydrogen bubbles evolved during electrolysis, the cathode wire net (fig. 1) may be curved, and may be allowed to abut against impervious channels (7) having openings allowing the hydrogen to escape easily; or the straight or corrugated cathode wire net is fixed with a slightly upward slope—a slope of $\frac{1}{20}$ is quite sufficient for the purpose. In order to raise its conductivity, the electrolyte may be warmed by a heating pipe, not shown in the drawing, and the apparatus only works well when suitable diaphragms are used. Diaphragms must be provided therefore, the permeability of which may be adjusted according to the liquid used, without opposing a high resistance to the current; these diaphragms must also be capable of being made to conform to the shape of the cathode. All solid diaphragms, such as corrundum compositions—cement, asbestos board, &c.—have been found to be unsuitable for this reason; and powder diaphragms are also inadmissible, since they cannot be moulded and are not permanent. The ordinary powder diaphragms cannot be used on sloping surfaces, because the powder soon slips off; moreover, they pack together and soon become impervious. For the same reason they cannot be used in combination with solid ribs. The desired result has been obtained in the Billiter cell by covering the wire net cathode with ordinary commercial asbestos cloth (1 in fig. 1), on which is spread a special powder diaphragm (2 in fig. 1).

According to the invention, the diaphragm composition is produced from a mixture of barium sulphate or alumina, with asbestos wool, and this is made into a plastic but tenacious and consistent mass, with a solution of common salt. Such mixtures of suitable powders with asbestos wool, can be made extremely quickly and easily. Whereas, for example, barium sulphate takes several hours to settle in the form of mud, a suspended mixture of barium sulphate powder with asbestos wool will settle in a few minutes, in a solution of common salt of 20 per cent. strength. This

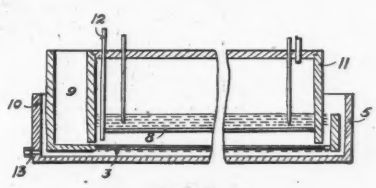



Fig. 2.

deposit, which has at first the consistency of a tenacious mud, can be easily dried, and can take any desired shape, which it retains during use, even when kept for a long time in liquids. According to Muhlhaus, the $BaSO_4$ is best precipitated hot, no change in the size or shape of the grains then occurs in the cell.

These diaphragms are stated to be extremely resistant, they will keep for months or years, and can be quickly and easily changed or renewed, as compared with the ordinary powder diaphragms. It is only necessary to remove the layer of mixed asbestos wool and powder, and to substitute a new layer, which can be done in a few minutes. As an alternative, the asbestos cloth may be taken out, a new one put in, and the diaphragm made up again.

* "The Principles of Applied Electrochemistry," Arnold, 1912.

In air, these diaphragms after a short time, dry completely, and become hard; they recover their original pliability and permeability on being placed for a short time in water or in a salt solution.

By altering the proportions of the mixture of asbestos wool and barium sulphate powder or alumina, and also by altering the thickness thereof, the permeability of the diaphragm can be graduated as desired. As a rule in the production of lyes of 8 to 13 per cent. strength, 190 grammes of $BaSO_4$ with 3 to 6 grammes of asbestos wool are used on 100 sq. cm. surface; for the production of 13 to 18 per cent. lyes, 275 grammes of $BaSO_4$, with 8 to 10 grammes of asbestos wool; and for the production of still more concentrated lye, 350 grammes of $BaSO_4$, with 15 grammes of asbestos wool, are employed.

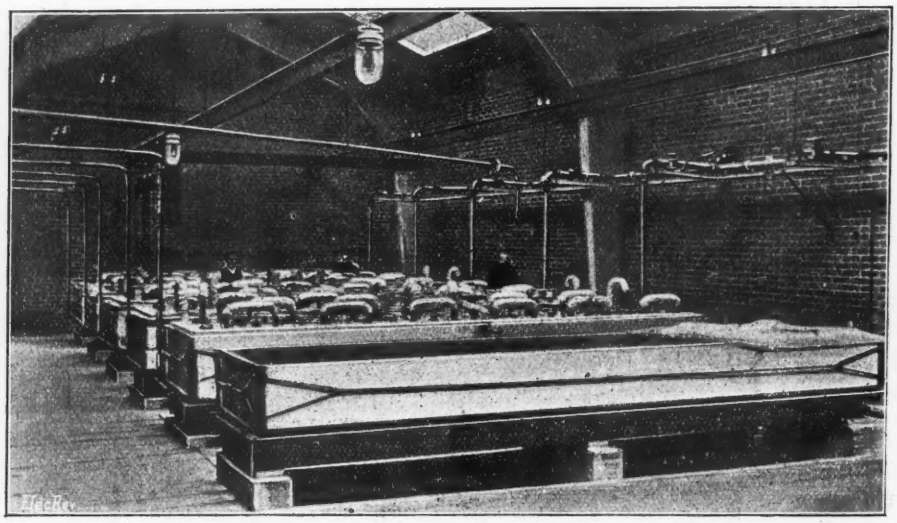


Fig. 3.—Alkali Cells at the Kaliwerke Aschersleben, Saxony.

During the electrolysis, soda lye is formed in the vessel (10), while chlorine ions pass to the anode, are there collected and evolved as gaseous chlorine. Fresh solution is added through the pipe (12), which extends down almost to the diaphragm. During the electrolysis, therefore, the upper part of the solution becomes poor in salt, and the lower part increases in specific gravity; as a result of this difference in specific gravity, a very sharply defined layer is formed directly above the diaphragm. To further facilitate the formation of the layers, a chamber or pocket (9), fig. 2, of impervious material may be fixed to the bell and charged with solid common salt, in order to keep the layer next the diaphragm constantly saturated, and so make it specifically still heavier. This is especially advisable when the feeding is purposely made very slow, in order to obtain highly concentrated lyes; otherwise the solution may readily become impoverished in salt.

The solution arrives at the cathode, not only through the diaphragm but also by being forced over a dam (5), fig. 2, so as to wash the underside of the cathode as well. The cathode net, therefore, is continually washed on its upper and lower sides by the overflow from the dam and by the passage of the solution through the diaphragm. In fig. 2 the intervening space between (5) and (11) is made much larger than it really should be, for clearness sake. In practice, this space is made as narrow as possible to prevent diffusion.

The cells may be made of various materials—such as glass, wire-glass or stoneware plates bedded in cement or asphalte, as shown in fig. 1; they can also be made of armoured concrete or of stone slabs. In small cells (up to 100 amperes) it is advisable to fix the asbestos cloth to the bell. The whole bell with the diaphragm can then be placed on a corrugated wire net, shaped to the form of the outer vessel. The bottom of this outer vessel (10) is advantageously made of sheet-iron, and it then forms a direct conductor for the current to the cathode net. In larger cells (above 100 amperes) this plan is scarcely practicable; and in such cells it is advisable to fix the cathode wire net to the bell. In order easily to renew the diaphragm, if required, without having to take out the bell, the lid of the latter is made readily removable. The asbestos cloth is not fixed to the bell, but is clamped to it by means of a framework of stone or of some other suitable material, with the help of wedges. A more effective joint can be made here if required, by means of an insoluble powder, this asbestos powder mixture being piled upon the diaphragm. In order to renew the diaphragm, it is only necessary to remove the lid, and to lift out the partition and the frame; after this has been done the diaphragm can be removed in a few minutes.

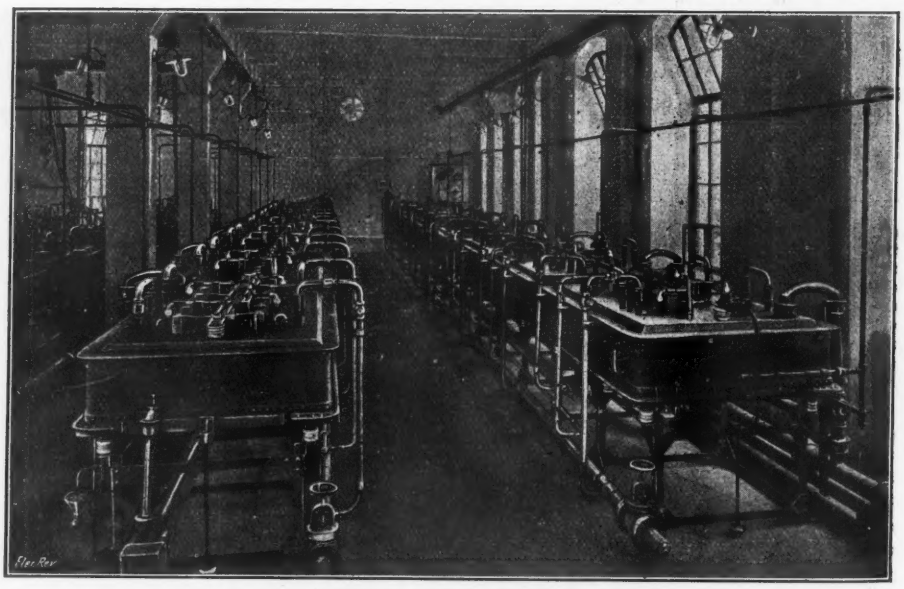


Fig. 4.—Billiter-Siemens Cells at a Bohemian Paper Works.

The experimental trials with this cell, gave a current efficiency of from 85 to 95 per cent., with a concentration

of soda lye of 12 per cent., and chlorine gas of 99 per cent. purity. In the patent specification, the inventor states that concentrations up to 15 per cent. NaOH can be obtained, and that a cell with a cathode surface of 1 sq. metre, when worked at 60° C., will take a current of 600 amperes, with an E.M.F. of only 4 to 4½ volts. According to Allmand, the heating of the cell is effected by means of earthenware pipes immersed in the brine at the top of the bell jars, through which hot water or hot brine is conducted. The anodes in practice are made of graphite or of fused magnetite ($Fe_3 O_4$) and are arranged horizontally over the diaphragm. The maximum capacity of each bell jar is 500 amperes, and six of these must therefore be grouped in one cell to give a unit of 3,000 amperes. Allmand also states that the brine must be purified before use, in order to remove iron and magnesium salts. This is a disadvantage, however, which the Billiter-Siemens cell and process suffers from in common with other cells of the gravity diaphragm type, such as the Finlay and Townsend cells.

The claims made for the Billiter-Siemens cell and process are :—(1) That it combines the advantage of the earlier diaphragm processes with those of the "bell" gravity cell, and that it overcomes the chief defects of both. (2) That the causes of low efficiencies in the open type of bell cell are checked ; (*a*) by the presence of the diaphragm ; (*b*) by the stratification of the liquors in the cell, and (*c*) by the direction of the flow of the electrolyte through the cell. These three conditions enable one to obtain a comparatively high current efficiency (for the type of cell) with a fairly concentrated solution of sodium hydrate at the cathode. The fact that the diaphragm is immersed in sodium hydrate solution, also contributes to its long life, and reduces the running costs of the process.

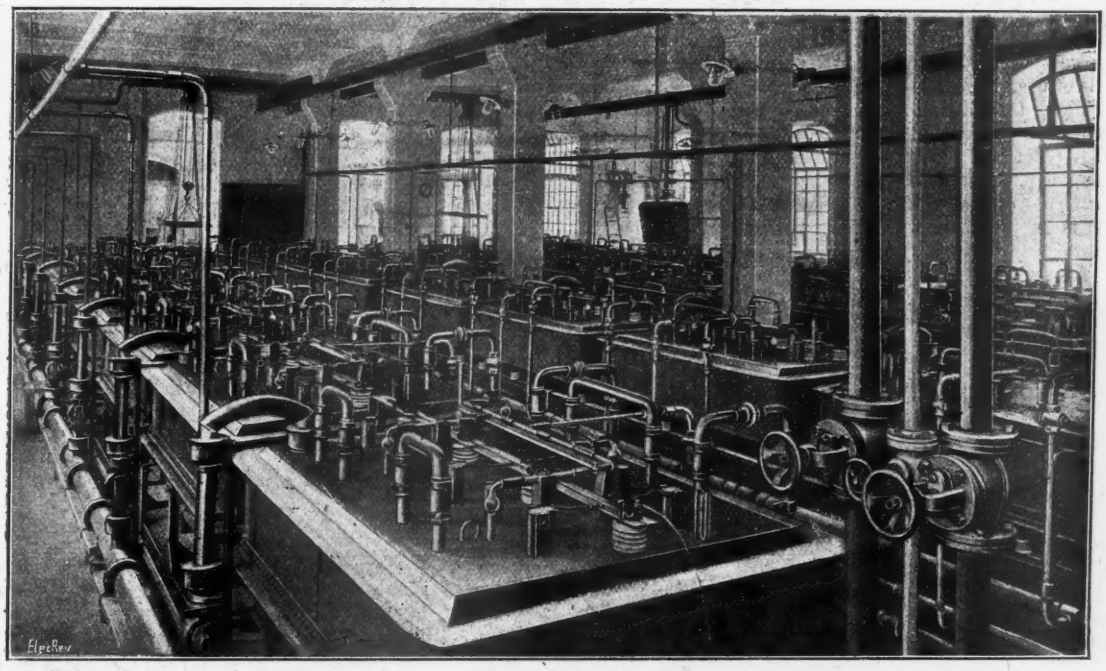


Fig. 5.—Electrolytic Cells at the Bohemian Paper Works of Spiro & Sohne.

## II.—Description of the Two Plants Illustrated.

*The Kaliwerke Aschersleben A.G., at Aschersleben, in Saxony.*—This plant is designed for the production of caustic soda or potash, and of chlorine gas, by the decomposition of sodium or potassium chlorine. Fig. 3 shows an internal view of the cell-room at this works, with six of the cells installed. The cells are long and narrow troughs constructed with granite side-walls, held together by corner anchor blocks and long iron rods, and are designed to utilise a current of 2,000-2,500 amperes. Each cell is provided with an iron bottom, and rests upon iron girders, which are insulated from the ground. The wire gauze-cathodes rest upon this iron bottom inside the cell, and in this way make contact with the current leads. The covers of each cell are made of earthenware, and are provided with the necessary openings for the anodes and for the pipes which carry away the chlorine gas, and also for the salt and the heating solutions.

The main supply pipes for the brine and heating solutions are placed underneath the baths in a wide channel in the floor of the cell room ; vertical branches lead from these to the cells. At Aschersleben the chlorine gas is employed in the chemical works, but for what purpose is not known. The caustic alkali solution is collected from the cells by a pipe running in a floor channel underneath the cells, and is led to a collecting chamber, from whence it is pumped into the concentrating pans, and is sold either as strong caustic liquid or as solid caustic. The hydrogen gas, which is liberated in the cathode compartment of the cells, is not used at the Aschersleben Works at present, but arrangements exist for its collection and storage, and it is probable that it will either be compressed and sold for balloon purposes, or utilised for the manufacture of ammonia by the synthetic process. In this connection it is interesting to note that several of the electrolytic alkali works are turning their attention to the utilisation of their hitherto wasted hydrogen for this new manufacture.

An overhead travelling crane is provided in the cell room, and by its means the cover of each cell, with its complement of connecting pipes and graphite anodes, can be quickly lifted clear of the cell, and any work required in the interior of the cell can then be carried out with a minimum of trouble and loss of time.

The electric current is conveyed to the cells by bare copper conductors laid on insulating blocks, and the cells are run in series with an E.M.F. of between 3·5 and 4·2 volts per cell, and a mean current intensity of 2,000 amperes. The connecting leads between the cells are so arranged that any cell can be cut out without disturbing the work of the remainder. At a trial run of this plant made in April, 1909, the following results were obtained :—Current intensity, 2,000 amperes ; voltage, 3·66 per cell ; current efficiency, 94·7 per cent. ; concentration of cathode liquor, 130 grammes NaOH per litre ; chlorine gas contained 1·17 per cent. $CO_2$ ; duration of test, 4 weeks.

The consumption of salt required with the Billiter cell is only a little above that required by theory, since the salt that remains undecomposed is fished out during the concentration of the caustic liquors, and is returned to the elec-

trolytic cells, with the fresh brine. Messrs. Siemens & Halske state, in fact, that 1 kg. of active chlorine can be obtained by this process, with an expenditure of electrical power of between 3-4 and 4 KW.-hours, with a consumption of only 1·8 kg. salt. The theoretical figures for 100 per cent. efficiency are 1·7 KW.-hours and 1·6 kg. salt.

*Plant at the Paper Works of Spiro & Sohne, at Krummau. a-d. Moldau, Bohemia.*—This firm produces sulphite cellulose for paper manufacture, and the electrolytic plant (which was erected in 1910) comprises 32 Billiter-Siemens cells, utilising a current of 500 amperes at 115 volts, and producing chlorine equivalent to 1,000 kg. bleach per day of 24 hours.

The general appearance of the cell-room at this works is shown in figs. 4 and 5. As will be seen from these views, the chief distinction between these cells and the earlier cells erected at Aschersleben, is in the form and construction of the cells. These are reduced considerably in size, and are now constructed of boiler-plate, provided along the four sides of the cell with a thick lining of cement, in order to confine the current to the iron bottom. This bottom is in contact (as before) with the negative wire-gauze electrodes.

Each cell contains 12 graphite anodes, the method of connecting these to the current leads is seen plainly in fig. 5. The 12 anodes in each cell are connected in parallel —the cells themselves are connected in series. The other details of the plant are as already described. The travelling cranes with their lifting frames for the cell covers, are seen plainly in the background of fig. 5. The chlorine produced at this plant is absorbed by milk of lime, and is used as calcium hypochlorite for bleaching purposes in the other departments of the works.

It is noteworthy that Messrs. Siemens & Halske have now convinced themselves, *by actual trials*, that this system of using the chlorine produced by the electrolysis of chlorides, is more efficient and economical than its use for the production of hypochlorites in the Kellner or any other type of hypochlorite cells. The disposal of the caustic liquors obtained as a by-product, is, however, a difficult matter for those industries in which no use can be found for these liquors.

*Yields and Costs.*—As regards the yields and costs of the Billiter-Siemens cell and process, the most reliable figures available are those given in a lengthy article upon "Die Betriebskosten der Chloralkalielektrolyse," contributed by Dr. V. Engelhardt to the *Chemiker Zeitung* in 1911. From this article the following figures are taken. These estimates, it may be explained, are based on the supposition :—(1) That both the chlorine and caustic alkali produced in the cell are worked up into solid form, and sold as 35 per cent. bleach and 73 per cent. caustic soda ; and (2) that the plant is of large size, and is fully equipped with all the necessary accessory plant for carrying on the process. The first estimate is based on the provision of electric power at a cost of ·235d. per KW.-hour, the second at a cost of ·587d.

*Details of Power Requirements.*—1,200 KW. for electrolytic cells ; 30 KW. for the bleaching powder plant ; 30 KW. for the caustic concentrating plant ; 20 KW. for pumps and fans ; 70 KW. for lighting and miscellaneous purposes ; total 1,350 KW.

*Output of Finished Products.*—Caustic soda 73 per cent., 3,560 ton per annum ; bleaching powder 35 per cent., 8,690 tons per annum.

*Capital Required.*—Electrolytic cells, £25,000 ; chemical plant, £27,000 ; buildings, &c., £23,500 ; working capital, £7,500 ; total, £83,000.

It may be noted that this estimated production of 8,690 tons of bleach (in the author's opinion) is too high, and a ratio of 2·1 tons, 35 per cent. bleach, to 1·0 ton of 73 per cent. caustic soda would have been more correct. The annual production of bleach by this plant would then be 7,476 tons, or 14 per cent. less than Engelhardt's total. The conversion of costs is based upon the ratio 20 M. (German) equals 19s. 6d. (English).

It will be noticed that the capital account does not include cost of land, and that the running costs do not allow anything for royalty on the process used.

TABLE II.—Summary of Costs for a Billiter-Siemens Electrolytic Plant Producing 3,560 Tons 73 per cent. Caustic Soda and 8,690 Tons 35 per cent. Bleach per Year.

No. 1 Estimate, with power at 2 pfg., or ·235d. per KW.-hour.
No. 2 Estimate, with power at 5 pfg., or ·587d. per KW.-hour.

| | No. 1. | No. 2. |
|---|---|---|
| Raw materials ... ... ... | £13,826 | £13,826 |
| Power ... ... ... ... | 10,530 | 26,325 |
| Maintenance and repairs ... | 6,825 | 6,825 |
| Packages, &c. ... ... ... | 5,265 | 5,265 |
| Wages ... ... ... ... | 4,875 | 4,875 |
| General expenses... ... ... | 2,292 | 2,292 |
| Oil, waste, &c. ... ... ... | 1,170 | 1,170 |
| Depreciation charges ... ... | 5,558 | 5,558 |
| Interest charges ... ... ... | 4,144 | 4,144 |
| Totals ... ... ... | £54,485 | £70,280 |

Taking the prices of 73 per cent. caustic soda and bleaching powder at the makers' works in West Lancashire on March 15th, 1913, at £9 15s. and £5 7s. 6d. per ton respectively, the value of the output of this plant would be as follows :—

| | |
|---|---|
| Caustic soda, 3,560 tons at £9 15s. ... ... | £34,710 |
| Bleaching powder, 8,690 tons at £5 7s. 6d. ... | 46,708 |
| Total ... ... ... ... ... | £81,418 |

Assuming that Engelhardt's estimate of the yield of bleaching powder for this plant is too high, and that the ratio of bleach to caustic soda is only 2·1 to 1·0, the total receipts from sales would be as follows :—

| | |
|---|---|
| Caustic soda, 3,560 tons at £9 15s. 0d. ... ... | £34,710 |
| Bleaching powder, 7,476 tons at £5 7s. 6d. ... | £40,183 |
| Total ... ... ... ... ... | £74,893 |

If these estimates be accepted as correct, the profits that can be earned by the Billiter-Siemens diaphragm cell, or by any other type of diaphragm cell, depend chiefly upon the question whether the electrical power for working the cell and process can be obtained for less than 5 pfg. (or ·587d.) per KW.-hr. Upon this point the author will have something to say in another article at a later date.

The writer's thanks are due to Messrs. Siemens & Halske, of Berlin, for the photographs, and to Dr. V. Engelhardt, of Berlin, for many of the figures used in this article.

## NOTES ON BUYING.

By G. BASIL BARHAM, A.M.I.E.E.

In every large electrical factoring or contracting business the position of buyer is one of extreme importance, and a great deal of responsibility must perforce rest on his shoulders, and a considerable amount of confidence must be placed in him by the firm by whom he is employed. It is consequently of importance that he should keep an exact account of the transactions in which he engages, so that his firm will have no difficulty at any time in referring to any negotiations with which he has been occupied or to business which he has carried out.

In a factoring business the selling organisation is largely, if not entirely, dependent upon him for the goods which are to be sold, and if those he purchases are not of the right grade or quality, or are bought at too high a price, or are not such as to either fill an existing or create a new demand, the sales department at first suffers, and ultimately rises up and demands an explanation.

In a contracting business the position is practically the same, except for the fact that the goods are in almost every instance bought for use, and not for re-sale. Purchases of poor or defective materials, payment of too high prices, over-purchasing, or the neglect to buy in time, all have a serious effect not only on the class of work done, but also on the time taken to carry it out. In such a business money may be, and frequently is, lost on a contract that should have proved most profitable, merely by reason of the buying having been done in a slipshod and inefficient manner.

In either class of business the buyer is, to a certain extent, dependent on the storekeeper. Unless he is furnished with all the facts relating to the quantities of materials in stock, the demands which exist and the output that is anticipated, it will be impossible for the buyer to keep the stock at a

proper level. The estimating department which prepares the tenders in a contracting business must also be kept in close touch with the buyer as, unless he is notified of the quantities of the different classes of material that will be wanted for each contract entered into, he will either be compelled to run the risk of overstocking so as to meet all possible contingencies, or else there will be a serious danger of the workmen finding themselves running short of some particular line as soon as the work is commenced.

It goes without saying that a buyer should not trust to his memory, but should tabulate everything in connection with his work in such a way that he can refer at a moment's notice to any particular item or detail. For instance, he must be able, without delay, to turn up the last quotations received from any firm, or all the quotations which have ever come to hand from different suppliers for any particular line of goods. He must have a record showing the names and addresses of every manufacturing house that is in a position to supply goods which he may be required to purchase. Further than that, he must have a readily accessible record of the terms which each of these factors or manufacturers have offered, such records showing whether goods are offered carriage paid or forward, and if the latter, what the carriage would amount to for certain definite quantities. Such records can only be satisfactorily kept by means of a card system which, whilst not being of a complicated nature, should be so arranged as to enable any and every detail to be looked up readily. The working of a card system is far from being so simple as it looks. Everyone in business uses a card index, but it has to be admitted that not all obtain the full advantages which should be secured. It is not in the province of this article to go into details as to the system, but it may be said that the employment of a sufficient number of guide cards simplifies its working. Where such an index is used alphabetically, it is apt to assume large proportions, and there is a grave danger of cards being misplaced and consequent confusion occurring. Undoubtedly, in such case, what is termed the vowel system should be made use of, in which every letter of the alphabet is divided into five sections, such as Ba, Be, Bi, Bo, Bu.

The use of a card index is only of advantage when the correspondence is carefully filed, and this of itself renders obsolete the press copying of letters. All replies must be filed in the shape of carbon copies with the inward letters, and this renders necessary the adoption of some simple definite system of transferring filed correspondence to filing cases, in which it is kept for reference. Where the system in vogue is that of merely transferring the entire contents of the correspondence files at stated intervals, there is often a great waste of time when anything has to be looked up, as, for a considerable time after the transfer has been made, all reference to filed correspondence must be to the transfer boxes as well as to the current file. A far better way is that in which the latter is allowed to run for a certain definite period, as 15 months, and then all letters bearing a date of more than 12 months back are taken out and placed in the transfer boxes. In that way, all recent correspondence is in the current files and is ready for immediate reference.

Of course, in a combined card index and file system no hard and fast rules can be laid down, as every business varies so considerably as regards the method in which it is carried out, that what would suit one house might prove to be a source of endless confusion and error if applied to the business of another. As a general thing, however, it will be found that the use of subjects rather than names for general correspondence will prove most satisfactory for a buyer's cards, although it may be necessary, if the business is large and has numerous ramifications, to employ both subject and name cards. But whatever method is adopted, the cards should contain the fullest possible information, and should show why any particular purchase was made, and give details as to the class and quality of the goods delivered. It should also record the time the firm took for delivery, the number of defective articles, if any, in the consignment, and whether the replacements were made and what time elapsed before they were received.

A subsidiary set of cards should be kept, made up from the storekeeper's weekly or daily reports, showing the amount of the different supplies that are in hand, the average time a certain quantity will last under ordinary conditions, and what orders, if any, are outstanding.

| Received from | Date | Purchase Order No. | Serial No. |
|---|---|---|---|
| Quantity | Description | | Weight |
| Condition | | Received by | |

Fig. 1.

Fig. 1 shows a type of card that could be used with advantage by the buyer to record the goods received from any firm, and whilst giving as full information as would be required in the ordinary business, may easily contain, written in the centre space, all the details specified above as being likely to prove of use in reference.

| To Purchasing Dept. | Department | Date | Serial No. |
|---|---|---|---|
| Quantity | Description | | |
| Requisitioned by | Dept. O. No. | Approved by | Purch. O. No. |

Fig. 2.

Fig. 2 shows a card which should be made up by the storekeeper when notifying the buyer of goods required to make up stock to fill either ordinary requirements or special orders. The card, as illustrated, is self-explanatory.

| Date | Department | Dept. O. No. | Serial No. |
|---|---|---|---|
| Quantity | Description | Weight / Rate / Value | |
| Requisitioned by | Issued by | | |
| Material issued | Put only one item on each card | | |

Fig. 3.

Fig. 3 is a sample of the cards that should be kept by the storekeeper to record the orders for stock received from the different departments which he has to supply.

If the business is large, and the purchases and stock carried are heavy, and consist of a great variety of commodities, it may be found of advantage to adopt a system of classification in which cards of different colours are used; or master cards can be compiled, each of which is a key to a set of cards on which the actual details are written. The quotations of each firm of suppliers should be recorded, a card being devoted to each class of goods, so that the offers received, not only from competing houses, but from the same firm at different times, can be instantly compared. It will be obvious that such a system permits of the removal of a good deal of obsolete matter, as these quotation cards can be dealt with in the same manner as outlined for the correspondence—that is to say, all cards dealing with quotations made six months or a year ago can be removed to transfer cases, to prevent the current index becoming too bulky. The most generally suitable size for the cards, it may be mentioned in passing, is 3 in. × 5 in. One thing is important, and

that is, that whatever the size adopted may be, sufficient space should be available to enable special notes to be made, as such provision not only reduces clerical labour, but ensures a proper record of everything of importance being kept.

It is not only in his own department that records must be fully and accurately kept for the buyer. The storekeeper must also be given the fullest facilities for keeping true records of all that is done. The old-fashioned stock book is more often than not a great time-waster, while a card system is not only simpler for stock-keeping, but is also far more accurate. The cards kept should be provided with space for date of order and delivery, purchase order number, sale order number, and quantities requisitioned, a model heading being as follows :—

| Date. | P. o. N. | Quantity. | Date received. | Quantity. | Date. | S. o. N. | Quantity. |
|---|---|---|---|---|---|---|---|

The above is only a suggestion, as the form of card would naturally be arranged to suit the requirements of the business. The character of the goods and the classification which had been determined upon by the buyer would naturally govern the arrangement of the storekeeper's index. But however the cards be arranged, it will be necessary for a great deal of thought and attention to be given to them before the final form is adopted. Then, if properly classified, they will be of considerable assistance in enabling the heads of the firm to keep closely in touch with every detail of the commercial side of the business without trouble and with absolute reliance in the accuracy of the facts recorded.

## REVIEWS.

*Electricity and its Practical Applications.* By Magnus Maclean. London : Blackie & Son. Price, 10s. 6d. net.

Electricity books and books on Electricity in enormous numbers are published nowadays—some large and pretentious, others small and unambitious—but we doubt whether twenty per cent. of these books serve any really useful purpose. It is certainly true that large numbers never get beyond their first edition and many others soon find their places in "the cemetery of dead books."

This purposeless production of books is all the more regrettable because of the lack of really sound books on electrical science, and also because many of the books predestined to failure on account of their purposelessness are written by capable men and contain excellent material. The cause of the trouble is not a simple one ; some books are cursed by meagre treatment, others by inordinate ambition to cover all the science in detail ; some fail because of adopting too mathematical a method and others because of extravagant attention to experimental details. But in general it may be said that the books that have failed have failed chiefly on account of lack of purpose—they were written in a general sort of way in the hope that they would be read in a general sort of way by the general student. The successful books have been written by men who have known their audiences and have studied the particular needs and difficulties of those audiences in order to write books to serve their needs and overcome their difficulties.

In the book before us Prof. Maclean has attempted to solve the problem of the student who enters upon a first year course in electrical engineering without having previously taken a preliminary course of physics. The problem is admittedly a difficult one, but Dr. Maclean has attacked it successfully, and by drawing on the work of Deschanel on the one hand, and on his own wide teaching experience on the other, has produced a good text-book of electrical engineering. As the technical instruction of engineers becomes more organised and progressive, we may hope to see the last of the type of student for whom the book has been primarily prepared, but even at that distant date we can prophesy with some certainty that "Maclean's Electricity" will be "still running."

It is interesting to notice the ease with which whole paragraphs from Deschanel's Natural Philosophy fit into this modern text-book of electrical engineering ; and although this method of treatment robs the book of the appearance of originality, it adds much to its usefulness.

The book consists of four parts : Electrostatics, Magnetism, Current Electricity and Direct-Current Generators. The first two parts are entirely descriptive, and follow very closely Deschanel's treatment ; the "engineering" part of the work begins with the "Current Electricity" section. Two chapters are devoted to electrochemistry and to the fundamental principles and experiments in electromagnetism, then follows an exceptionally well-conceived and well-illustrated chapter on Ammeters and Voltmeters. Wattmeters are also treated in considerable detail.

It is difficult to give an adequate impression of the chapter on E.M.F. and Resistance ; for, although it is only 20 pages long, it contains all the fundamental concepts of E.M.F., potential difference, Ohm's law, shunts, Kirchoff's laws, Joule's law, Wheatstone's bridge, various methods for measuring high and low resistances, and a complete description of two types of insulation testers—a most remarkable electrical *multum in parvo*.

It would seem invidious to criticise where so much is excellent, but the weak point in the book is undoubtedly the meagre treatment of so fundamental a subject as electromagnetic induction. The introductory statement that "The discovery (of induced currents) by Faraday in 1831 constitutes an epoch in the history of electrical science," would seem to justify something more than the bare statement of laws and descriptions of experiments which occupy the first four pages of the chapter. The rest of the chapter is devoted to the more fascinating, but less practical, subject of the conduction of electricity in gases. The sections on the storage battery are very complete and well written, while the chapters on arc lamps and incandescent lamps are probably the most exhaustive and up-to-date to be found in any text-book, metallic filaments being treated in great detail.

The treatment of power distribution is based on essentially practical lines, but, as the book does not deal with A.C. generators, the transmission of A.C. power is also omitted, so that the author has not to devote his space to detailed discussions of two or three-wire transmission systems, but is free to deal very thoroughly with some practical problems in main-laying and wiring.

The chapters on armatures and field magnets are clearly written and unusually well illustrated with good line diagrams. The concluding chapters on types of dynamos and motors are well up to the general standard of the rest of the book ; the characteristic curves are clearly drawn and discussed, and such important subjects as armature reaction, prevention of sparking, starters and controllers, are given due consideration. Some appendixes and tables of constants are also added.

The book is well bound and indexed, and is, on the whole, one of the best text-books of electrical engineering that we have seen.—P.H.S.K.

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*Electrical Machine Design.* By A. Gray. 1913. London : Hill Publishing Co., Ltd. Price 17s. net.

The design of electrical machinery is an art to be acquired by practice, as well as a science to be understood and reasoned about, and no mere list of formulæ or collection of rules will enable a man to become a skilled designer. On the other hand, every designer collects data from his own experience, which he tabulates and analyses for future reference. This information is, of course, much more valuable to the compiler of it than to anyone else, but a student commencing design, having no experience, must fall back on the collected data of someone else. Hence the book under review—compiled as a course of lectures on electrical machine design at McGill University—will prove useful to those for whom it is intended.

The book is divided into four sections, dealing respectively with direct-current machinery, alternators and synchronous motors, polyphase induction motors and transformers, the general scheme being to build up the design on fundamental principles as far as possible.

Chapter I is introductory, and deals with the elements of magnetic induction, while Chapter II gives a shorter description of armature winding schemes, the nomenclature

adopted being that due to Parshall and Hobart. Coloured, instead of small black lined, diagrams would have been an improvement. The construction of machines is very briefly described in Chapter III, only two small illustrations being used.

Following, we have 12 pages devoted to the insulation of machines, with several examples of armature and field insulation.

Chapters V and VI deal with the theory of the magnetic circuit and armature reaction respectively, the treatment being along standard lines. The design of the magnetic circuit is discussed in Chapter VII. The usual methods are described, but the American units of circular mils per ampere, and the Brown & Sharp wire "gage" are used in illustration of the methods, which will probably not be familiar to English students.

Chapters VIII and IX give the theory of commutation, determination of reactance voltage, methods of reducing sparking, &c. Efficiency and losses, and heating, are treated respectively in the two succeeding chapters, in which a number of useful formulæ and curves are given.

Chapter XII considers procedure in armature design, and a 400-KW. armature is worked through in exemplification. The remainder of the direct-current section deals with motor design and ratings, limitations in design, interpole machines, and specifications, and is in no way remarkable.

In Chapter XVII, the first one in the second section of the book, we find a good description of alternator windings.

The generated E.M.F. is discussed fully in the next chapter, very clear descriptions being given of the numerous factors requiring consideration—such as the effect of harmonics due to armature slots, &c. The construction of alternators is dismissed in the succeeding four pages.

The information regarding the insulation of alternators given in Chapter XX is accurate, clear and concise. Typical methods of insulating several high-voltage alternators are described. Chapter XXI deals with the complex problems arising from armature reaction, and a good description of approximately calculating the leakage reactance is given. General considerations regarding the design of ordinary alternators are then described, and a 40-KW. machine is worked through.

A good outline of the serious difficulties attending the design of turbo-alternators is then given, together with the various methods now in common use for predetermining, and thereby eliminating, reducing, or overcoming them. Chapters XXVI and XXVII deal respectively with special problems on alternators, such as dampers, self-starting synchronous motors, &c., and specifications. The elementary theory of operation, and the graphical treatment of induction motors are described in the next three chapters. The interpretation of the Heyland circle diagram is put forward in a decidedly satisfactory manner.

The remainder of this section is devoted to the actual design and heating of induction motors, the treatment, on the whole, being good, but it is rather a pity that the actual construction of these machines is treated in such a meagre fashion.

Chapters XL and XLI deal with the working and construction of transformers. The reviewer has no fault to find with the vector diagrams in the former chapter, but he is of the opinion that the several rather poor reproductions of photographs in the latter chapter might have been advantageously replaced by plates of working drawings. Following these we find two short chapters briefly considering the magnetising current, iron loss and leakage reactance of transformers. Transformer insulation, losses and heating next receive attention, the information being full and up-to-date.

The actual design of transformers is next entered upon, and two examples are worked through at length. Auto-transformers are not touched upon—a fact which is to be regretted, since for small ratios of transformation the economy in first cost for this type of transformer is very considerable.

The three concluding chapters deal respectively with special transformer problems, transformer specifications, and the mechanical design of machines. In the latter chapter are given the investigation of the unbalanced magnetic pull due to an eccentric rotor, dimensions of bearings, journals, pulleys, &c.

The book is well printed and bound, and is singularly free from misprints for a first edition. While it contains practically no original matter, it is a good *résumé* of the subject, and would probably have a fair sale in this country, if it were not for the fact that it suffers from the complaint common to so many American books, *i.e.*, it is expensive. Perhaps the American student has more money in his pocket than his English counterpart.—H. G. S.

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*La Télégraphie et la Téléphonie Simultanées, et la Téléphonie Multiple.* By K. Berger, Inspecteur Supérieur des Postes d'Allemagne. Translated into French by P. Le Normand, Ingénieur des Postes et Télégraphes. Paris: Gauthier-Villars. Price 4.50 fr.

The painstaking thoroughness of German writers in all branches of science is well known to those who have had the opportunity of acquiring their language. Unfortunately, however, in this country a knowledge of German is still rare among engineers, and a large amount of information is thus shut off from many to whom it would otherwise be extremely valuable. Translations of German works are therefore welcome, if not in English, then, at least, in French, a reading knowledge of which, at any rate, is possessed by most of us.

The question of the simultaneous use of the same circuit for telegraphic and telephonic purposes, or for more than one telephone connection, has come prominently to the fore in recent years, owing to the great development in telephone requirements. The present volume gives an account of the history and present position of this phase of telegraph engineering, as far as the Continent of Europe is concerned.

In a brief introduction the arrangements used by Zetzsche in 1878 for simultaneous telegraphy and telephony, and by Elsasser in 1885 for multiple telegraphy, are described, and a general survey is taken of the various problems which are met with and the methods by which they can be solved.

Part I is divided into two sub-sections, telephony on single-wire telegraph lines, and telegraphy on metallic-loop telephone circuits. The author first deals with the Van Rysselbergh system. In this system the telegraph signals are prevented from being heard in the telephone receivers by the use of condensers and inductances, joined up in such a manner that the rate of change of the telegraph currents at the beginning and end of each signal is reduced so as not to cause the telephone diaphragm to move in the sudden manner necessary for the production of a sound. Several other arrangements, by which the telegraph signals can be prevented from influencing the telephone receivers, are also described.

Telegraphy upon metallic-loop telephone circuits is then considered. With such circuits much more efficient methods of separating the telegraph currents, for which an earth return is used, from those of the telephone circuit flowing round the loop, are available, based on the principle of the Wheatstone Bridge. Descriptions are given of the various bridge methods, and of the arrangements by which these methods are applied in practice. The means by which different portions of the same telephone circuit can be used for distinct telegraph circuits, and *vice versâ*, are then discussed.

In Part II the subject of multiple telephony is considered. The historical developments of the subject are first traced, and afterwards the principles of the methods used in modern multiple telephony and their practical applications, including superimposing on loaded telephone lines, are described.

The arrangement of the lines necessary to prevent inductive troubles, which cause serious difficulties in the case of superimposed telephone circuits, is next considered, and the second part concludes with a brief survey of the conditions which govern the desirability or otherwise of introducing superimposed working.

In an appendix a description is given of the Picard system of multiple telegraphy, by means of which the same line can be used for two distinct telegraph circuits.

The author gives a large number of references to the various sources from which he has derived his information, so that the reader is enabled to follow up in detail any particular portion of the subject which he may wish to investigate more thoroughly.

As is usual with French works, the book is bound only in paper. The paper and printing, however, are good, and the diagrams and illustrations are very clear.

## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

CHILE.—The Government proposes to establish a new tariff of import duties to take the place of the present *ad valorem* tariff. Certain recommendations have accordingly been made by a Tariff Commission which was appointed for the purpose, of which the following will be of interest to readers of the ELECTRICAL REVIEW :—

| | *Dollars per kg.* |
|---|---|
| Celluloid manufactures ... ... ... ... ... | 4·00 |
| Wire, of iron, galvanised or not ... ... ... ... | ·01 |
| Electric pumps of iron ... ... ... ... ... | ·70 |
| Electric meters ... ... ... ... ... ... | ·20 |
| Springs for tramway cars, &c. ... ... ... ... | ·10 |
| Wire of metal of all kinds ... ... ... ... | ·01 |
| Asbestos manufactures ... ... ... ... ... | 2·00 |
| Mica in sheets ... ... ... ... ... ... | ·60 |
| Mica manufactured ... ... ... ... ... | ·75 |
| Tramway cars ... ... ... ... ... ... | ·10 |
| Scientific instruments ... ... ... ... ... | free |
| Telegraph and telephone instruments and apparatus ... | ·05 |
| Machinery, apparatus, &c., for producing light by gas or electricity, insulators, commutators, interruptors, &c., necessary for electric lighting, arc lamps, incandescent lamps and carbons ... ... | ·04 |
| Electric batteries and jars for same ... ... ... | ·05 |
| Wire insulated with rubber, silk or other material ... | ·10 |

N.B.—Chilean dollar = 1s. 6d.

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

**Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.**

17,225. "Chains for supporting pendant electric lights, and for other like purposes." C. I. CLEMENTS. July 28th.

17,239. "Starting arrangements for engines using magneto ignition." T. J. E. ROBERTS and J. H. W. ROBERTS. July 28th.

17,245. "Lighting systems for kinematographs." C. ZEISS (Firm of). (Convention date, August 17th, 1912, Germany.) July 28th. (Complete.)

17,261. "Electric conductor for explosive charges." H. J. VON KLAEDEN. July 28th. (Complete.)

17,264. "Electric ovens and the like appliances." M. RAILING and G. H. IDE. July 28th.

17,265. "Electrically illuminated letters, signs, and the like devices." H. HIRST and B. H. JENKINSON. July 28th.

17,268. "High-speed motors for high-frequency multipolar electrical machinery." R. GOLDSCHMIDT. (Addition to 10,507, 1912.) July 28th. (Complete.)

17,275. "Electrical switches." W. J. FAHN and J. C. HUTTON. July 28th. (Complete.)

17,284. "Current motors." J. W. INGOSON. July 28th. (Complete.)

17,326. "Vapour electric devices." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) July 28th.

17,345. "Electric cut-outs." T. E. MURRAY, JUN. (Convention date, February 4th, 1913, United States.) July 28th. (Complete.)

17,351. "Ignition plugs, pressure connections and compression taps for internal-combustion engines." C. HUTCHINSON. July 29th.

17,361. "Means for, and methods of, changing the frequency of alternating electric currents." A. M. TAYLOR. July 29th.

17,384. "Multiple-way electric switches." A. P. WELCH and H. M. K. MCCABE. July 29th.

17,416. "Electric glow lamps." SIEMENS & HALSKE AKT. GES. (Convention date, August 2nd, 1912, Germany.) July 29th. (Complete.)

17,417. "Circuit arrangements for telephone systems." SIEMENS & HALSKE AKT. GES. (Convention date, July 30th, 1912, Germany.) July 29th. (Complete.)

17,418. "Electric switch." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt. Ges., Germany.) July 29th. (Complete.)

17,453. "Electric cooking and heating apparatus." C. CLARKE. July 30th.

17,473. "Protective covering for sparking plugs" H. G. LONGFORD and W. W. LONGFORD, trading as Sphinx Manufacturing Co. July 30th.

17,480. "Magnet core for use in Ferrari's electricity meters." LANDIS AND GYR G.m.b.H. (Convention date, July 31st, 1912, Germany.) July 30th. (Complete.)

17,490. "Process for heating articles in electric furnaces." F. FISCHER. (Convention date, November 5th, 1912.) July 30th. (Complete.)

17,491. "Portable electric lamps." G. F. HITZELBERGER and NEW BRITISH EVER-READY Co., LTD. July 30th.

17,498. "Safeguard for the front of motor or electric-propelled vehicles." E. MOIR, E. WINEBERG and M. WINEBERG. July 30th.

17,529. "Apparatus for electrically igniting miners' safety lamps." V. E. JOYCE and SPAGNOLETTI, LTD. July 30th.

17,562. "Electric circuit-closing devices." SIEMENS-SCHUCKERTWERKE G.m.b.H. (Convention date, August 16th, 1912, Germany.) July 30th. (Complete.)

17,562. "Variable electric resistance device." W. P. THOMPSON. (Soc. Anon. des Telegraphes Edouard Belin, France.) July 31st. (Complete.)

17,572. "Party line ringing systems." WESTERN ELECTRIC Co., LTD. (F. T. Woodward, Belgium.) July 31st. (Complete.)

17,583. "High-tension electric switches." AKT. GES. BROWN, BOVERIE ET CIE. (Convention date, August 19th, 1912, Germany.) July 31st. (Complete.)

17,584. "Vents for electric accumulator cases and other receptacles." H. LUCAS and O. LUCAS. July 31st.

17,589. "Control of alternating-current motors." SIEMENS-SCHUCKERTWERKE G.m.b.H. (Convention date, August 2nd, 1912, Germany.) July 31st. (Complete.)

17,603. "Electro-plating apparatus." T. R. CANNING. July 31st.

17,604. "Switches for opening and closing electric circuits." H. LEITNER. July 31st.

17,607. "Electrical systems." R. VARLEY. July 31st. (Complete.)

17,625. "Generation of electrical power and asynchronous-synchronous, transformer-motor, systems of electrical transmission of same, with means of speed regulation, in electrical propulsion of ships, railway, tramway, road, aeronautical, agricultural, military, submarines, locomotives, trains or similar self-contained or other vehicles; means of driving, mining, printing, laundry, agricultural, ship-auxiliary and other industrial machinery; means of generating high and variable frequency current for radio-telegraphy, radio-telephony, lighting, analogous-applications and the like." W. P. DURTNALL. July 31st.

17,629. "Double automatic switch." H. M. L. GABLER. July 31st.

17,634. "Electric lock." G. J. F. NEWEY and H. HOPKINS. August 1st.

17,665. "Electrically heated flat irons." SIEMENS SCHUCKERTWERKE G.M.B.H. (Convention date, August 6th, 1912, Germany.) August 1st. (Complete.)

17,681. "Electric lighting." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) August 1st.

17,688. "Electric cooking apparatus." M. J. RAILING and G. MAURICE. August 1st.

17,712. "Blow-outs for electric currents." SIEMENS BROS. DYNAMO WORKS, LTD., and R. A. R. BOLTON. August 1st.

17,719. "Electric lamp signalling." SIEMENS BROS. & Co., LTD. (Siemens and Halske Akt. Ges., Germany.) August 1st. (Complete.)

17,725. "Dynamo-electric machines." D. H. ANDREWS and E. C. KETCHUM. August 1st. (Complete.)

17,733. "Galvanometers, voltmeters, ammeters, and like instruments. GAMBRELL BROS., LTD., and A. ONWOOD. August 1st. (Complete.)

17,736. "Means for, and method of, changing the frequency of alternating electric currents." A. M. TAYLOR. August 1st.

17,759. "Electrolytic electrodes." SCHNOTT & GEN. (Convention date, August 21st, 1912, Germany.) August 2nd. (Complete.)

17,761. "Watertight electric switch-controller wall sockets." R. G. TYLER, E. H. FREEMAN and F. G. SHREWSBURY. August 2nd.

17,775. "Electrical switches or interrupters for telephone circuits and like purposes." W. A. LOGAN. August 2nd. (Complete.)

17,795. "Incandescent electric lamps." K. PROSYNSKI. August 2nd.

## PUBLISHED SPECIFICATIONS.

**Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).**

### 1913.

TELEPHONE REPEATER SYSTEMS. E. Grissinger. 2,980. February 4th. (Divided application on No. 7,482 of 1912, March 27th.)

KEYBOARD TELEGRAPH TRANSMITTER. E. J. Kessels. 3,582. February 11th. (Addition to No. 21,332 of 1912.)

PRIMARY ELECTRIC BATTERIES. G. S. Engle. 3,861. February 14th. (October 8th, 1912.)

GOVERNING TURBINES OPERATED BY HIGH AND LOW-PRESSURE ELASTIC FLUID. Bergmann Elektricitäts Werke Akt.-Ges. 5,317. (March 22nd, 1912. Addition to No. 4,694 of 1913.)

APPARATUS FOR PRODUCING STAGE ILLUSIONS. L. McCormick. 7,007. March 22nd. (February 10th, 1913.)

ARRANGEMENT OF CURRENT TRANSFORMERS FOR HIGH VOLTAGES. Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges.) 8,027. April 5th.

AUTOMATIC SINGLE-POLE ELECTRIC SWITCH. W. E. Gorton. 608. January 8th. (May 16th, 1912.)

PROCESS AND DEVICES FOR PRODUCING IN A CONTINUOUS MANNER ROENTGEN RAYS HAVING ANY DESIRED DEGREE OF HARDNESS WHICH CAN BE ADJUSTED AT A MOMENT'S NOTICE, J. E. Lilienfeld. 1,849. January 22nd. (Addition to No. 25,169 of 1912.)

REMOTE-CONTROLLED CIRCUIT-BREAKER. S. Whipp, C. W. D. Bourne and F. Whipp. 2,233. January 25th.

CONSTRUCTION OF PORTABLE SECONDARY BATTERIES. E. J. Clark and Hart Accumulator Co. 2,908. February 4th.

APPARATUS FOR PRINTING TICKETS OR THE LIKE AUTOMATICALLY BY SELECTORS. Allgemeine Elektricitäts Ges. 3,680. February 12th. (February 23rd, 1912.)

ELECTRIC LEAKAGE TELEGRAPHY OR TELEPHONY. Signal Ges. m.b.H. 3,853. February 14th. (February 17th, 1912.)

ELECTRICAL SOCKETS FOR FUSE PLUGS, ELECTRIC LAMPS AND THE LIKE. Siemens Schuckertwerke Ges. 5,909. March 10th. (March 20th, 1912.)

AUTOMATIC FIRE-ALARM SYSTEMS. E. Garretson. 7,288. March 27th.

BAYONET-SOCKET HOLDERS FOR INCANDESCENT ELECTRIC LAMPS, ELECTRIC COUPLINGS AND THE LIKE. United Motor Industries, Ltd., and E. De Rodakowski. 7,477. March 29th.

OPTICAL RECEIVERS FOR FACSIMILE TELEGRAPHS. C. Stille. 9,061. April 17th. (April 24th, 1912.)

POLE CAPS AND INSULATOR SUPPORTS. H. Forster. 10,085. April 29th. (April 29th, 1912.)

MACHINE TELEPHONE SWITCHING SYSTEMS. Western Electric Co. (Woodward.) 12,423. May 28th. (Divided application on 15,952, 1912, July 8th.)

MACHINE TELEPHONE SWITCHING SYSTEMS. Western Electric Co. (Woodward.) 12,424. May 28th. (Divided application on 15,952, 1912, July 8th.)

MACHINE TELEPHONE SWITCHING SYSTEMS. Western Electric Co. (Woodward.) 12,425. May 28th. (Divided application on 15,952, 1912, July 8th.)

MACHINE TELEPHONE SWITCHING SYSTEMS. Western Electric Co. (Woodward.) 12,426. May 28th. (Divided application on 15,952, 1912, July 8th.)

DEVICE FOR LIGHTING GAS LAMPS. H. S. Cooke and F. Westwood. 13,140. June 6th. (Divided application on 152, 1912, July 2nd.)

DEVICE FOR LIGHTING GAS LAMPS. H. S. Cooke and F. Westwood. 13,141. June 6th. (Divided application on 152, 1912, July 2nd.)

PORTABLE ILLUMINATED ADVERTISING POUCH AND SILENT SALESMAN. A. Milhado. 2,192. January 27th.

SPARK PLUGS. F. R. Blake. 4,381. February 20th.

ELECTRIC CLOCKS. F. Brunko. 7,275. March 27th. (April 1st, 1912.)

ELECTRIC GLOW LAMPS. C. B. Herrmann. 8,198. April 7th. (December 16th, 1912.)

ELECTRIC HEATERS FOR LIQUIDS. C. O. Haskell. 8,595. April 9th.

ELECTRICITY MOTOR-METERS OF THE MERCURY TYPE. Compagnie pour la Fabrication des Compteurs et Materiel d'Usines a Gaz and Brocq. 8,601. April 11th.

METHODS OF EQUALISING THE LOAD ON SYSTEMS OF SUPPLY FOR ALTERNATING-CURRENT ELECTRIC MOTORS. S. Eckmann. 9,174. April 18th. (Addition to, and divided application on, No. 11,597 of 1912, November 14th.)

APPARATUS FOR ELECTRO-OSMOTIC EXTRACTION OF WATER FROM SUBSTANCES. Ges. für. Elektro-Osmose and G. B. Schwerin. 10,873. May 8th. (Addition to No. 23,545 of 1912.)

ELECTRIC DISCHARGE APPARATUS. R. Moretti. 13,918. June 16th. (Divided application on, and addition to, No. 16,164 of 1912, July 10th.)